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Contents

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THE CASE FOR EXOGENOUS RHYTHMS

BY EDWARD R. DEWEY

Rhythm is the tendency of certain phenomena to repeat with reasonable regularity—that is, to repeat with a *beat*. It thus differs on the one hand from *periodicity*, a word used to denote absolute regularity, and, on the other hand, from *cycle*, a word used to denote any sequence of events which comes around, more or less, to the place of beginning.

An exogenous rhythm is, of course, one caused by a rhythmic force external to the phenomenon or system involved, in contrast to an endogenous rhythm which is one that arises within the phenomenon or system.

Rhythm is quite general throughout nature, as illustrated by Figs. 1—8.

When you see a chart that shows rhythm your first reaction should be that the regularity of timing is mere coincidence. Unless a rhythm has repeated *enough* times and with *enough* regularity it should be ascribed to chance.

If a rhythm has repeated so many times and with such regularity that it cannot reasonably be the result of chance, your next reaction should be to suppose a cause within the phenomenon, or at least the system of which the phenomenon is a part. Perhaps a preditor-prey or feed-back mechanism would be suggested. Such would be the simplest explanation, and, therefore, the proper one—if it is tenable.

Here, for example, is an index of lynx abundance in Canada, 1735—1958, a period of 224 years (Fig. 9). We notice a 9.6-year rhythm of such great clarity that the regularity cannot be the result of chance. Is it endogenous? Many biologists think so.

But if we study the whole field of rhythm we find many other examples of phenomena that are characterized by 9.6-year cycles. If they are not part of the lynx system, one phenomenon must force the other, or they must have a common cause. The 9.6-year cycle in the abundance of rabbits, the 9.6-year cycle in tularemia, and the 9.6-year cycle in the abundance of ticks may be part of the ecological system of the lynx. And perhaps we should ignore the 9.6-year cycle in the abundance of other Canadian mammals such as the wolf, the marten, and the red, cross, and silver foxes. Conceivably they are part of the ecological system of the lynx, too, although it is hard for a non-biologist to see how they could be.

But how about the fact that tent caterpillers in New Jersey, Atlantic Salmon in Canada and at Wye in England, human heart disease in Northeastern United States, and the acreage planted to wheat in the United States are all characterized by the same 9.6-year rhythm? (See Figs. 10—17.) Lynx may eat rabbits, but surely they don't eat salmon, or farmers. The facts suggest at least the possibility that the rhythm may be the result of some exogenous factor common to lynx, salmon, insects, and man. This idea is reinforced when we note that the turning points of all these various rhythms come at more or less the same time.

If we adjust the lynx figures for the 9.6-year cycle, just as we would adjust a series of monthly figures for seasonal variation, an 8-year cycle remains. It is as if the lynx were subject, simultaneously, to two rhythmic forces.

An 8-year cycle is also a commonplace to cycle students. It is found in such diverse phenomena as a) lynx abundance in Canada, 1735—1950, b) pig iron prices, U.S.A., 1784—1951, c) steel ingot production, U.S.A., 1867—1955, d) sunspots with alternate cycles reversed, 1749—1949, e) cigarette production, U.S.A., 1880—1955, f) Goodyear Tire and Rubber Company sales, 1926—1955, g) railroad stock prices, U.S.A., 1831—1955, h) sales of Company G, 1913—1955, i) rainfall, U.S.A., 1881—1921, j) rainfall, Ohio, c. 1800—c. 1900, k) average yield of chief crops in Illinois, 1881—1921, l) Sauerbeck Index of wholesale prices, England, 1818—1913, m) purchasing power of eggs, U.S.A., 1873—1936. (See Table 1 and Figs. 18—23.)

The 5.91-year cycle is another cycle that

has been widely observed. (See Table 2 and Figs. 24—27.)

I could give you scores of examples of unrelated phenomena that have rhythms of the same wave length with turning points that come more or less at the same time, but two more may suffice to clinch the point.

Here are charts of the 9.2-year cycle in pig iron prices, U.S.A., grasshopper abundance, U.S.A., railroad stock prices, common stock prices, business failures, and patents issued. (See Figs. 28—33.)

Here also is a pair of charts showing the 22 2/3-year cycle in grasshopper abundance, U.S.A. (Fig. 34) and the European partridge in Czechoslovakia (Fig. 35). Twenty-two and 2/3 years is a length also present in weather.

These illustrations serve to point up the desirability of attacking the subject of rhythm on a broad front, regardless of discipline.

However, we do not need to find a variety of phenomena of the same wave length to get a suggestion of an external cause. If the rhythm has enough repetitions, and particularly if it extends over a long period of time, we may suspect exogenous forces—now that we have got used to the possibility that such forces may exist. (A long period of time offers a variety of environmental conditions.) Here, for example, are charts showing a 9.18-month cycle in Canadian Pacific Railway ton miles for some sixty repetitions (Fig. 36), a 16 2/3-year cycle in wrought iron prices in England, 1287—1908 (before, during, and after the Industrial Revolution) (Fig. 37), a 54-year cycle in wheat prices in England, 1270—1930 (Fig. 38), and a 142-year cycle in war, 1 A.D. to 1915 (Fig. 39).

When a cycle resulting from internal forces is distorted, its waves do not resume in phase with the old pattern, except by accident. Conversely, when the waves do resume in phase with the old pattern, we have the suggestion of a possible external cause for the rhythm. All the charts shown so far illustrate instances of distorted rhythm that reverted to the old pattern. Here are some additional examples. During the last war, passenger car production in the United States was completely halted. Yet, when it resumed, the 3.4-year cycle in the post-war figures was exactly in phase with this cycle in the pre-war figures (Fig. 40). The return to a previously established pattern is also seen in the chart of the 3-year cycle in automobile sales, the 32.86-month cycle in Canadian Pacific Railroad revenue ton miles, and the 32.3-month cycle in residential building construction contracts awarded. (See Figs. 41—43.) An accident? Perhaps. Perhaps not.

Rhythms that are endogenous would not show geographical pattern, except by accident, either. Charts showing the timing of cycles present on the average in weather at different stations throughout the world do, however, show pattern. (See Figs. 45—49.) The pattern is similar to that evidenced by sunspots. That is, the waves crest later and later as found from either pole toward the equator (Fig. 44). Animal abundance figures, where available, behave the same way. These facts also suggest the possibility of external influences. What these influences are, is as yet unknown.

A final reason for thinking that the cause of at least some of the rhythms may be forced is found in the fact that rhythm wave lengths seem to occur in *families*. The members of these families are related to each other by simple multiples of two or three. An example of a family of this sort is shown in Table 3.

These are a few of the reasons and instances that suggest that at least some of the rhythms we observe may be exogenous. A complete catalog would fill a book.

Biologists who come across rhythms that might possibly be exogenous can help solve the major problem of rhythm as such by doing the following: making the most accurate possible determination of wave length (at least within 1%), wave strength, wave shape, calendar timing, dominance, and regularity; and always reporting the locus of behavior, the techniques used for isolating and definitizing the rhythm, and the raw data, when these are not readily available in the literature.

Perhaps, if all disciplines work together, we can eventually determine the forces that cause these peculiar behaviors, their interrelationships, their laws.

Illustrations of Some Rhythmic Cycles in Various Phenomena

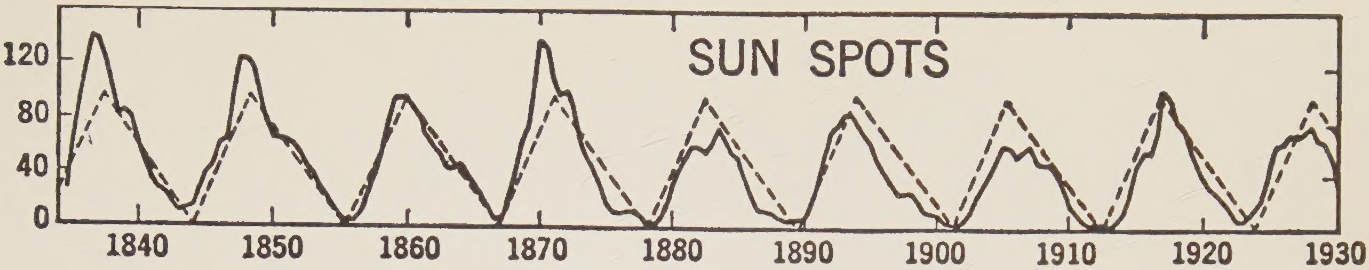


FIG. 1: ABUNDANCE OF SUNSPOTS

Sunspot numbers, 1835—1930. (Carnegie Institution of Washington.) A regular 11.4-year cycle has been added. Taken over a longer time-span, the period averages somewhat less. Source: Dewey and Dakin, *Cycles, the Science of Prediction.* 1947. p. 64.

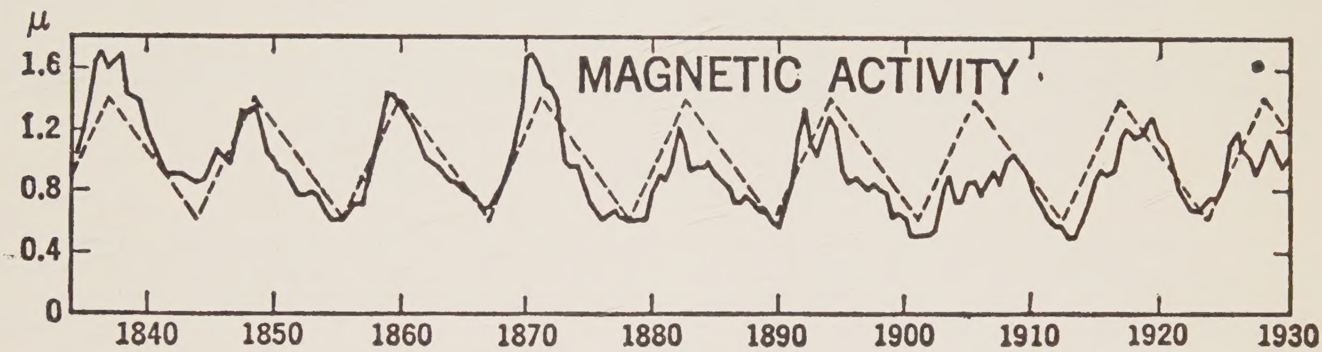


FIG. 2: VARIATION IN TERRESTRIAL MAGNETISM

Magnetic activity, 1835—1930. (Carnegie Institution of Washington.) A regular 11.4-year cycle has been added. Note the close correspondence with the curve of the sunspot numbers. Source: Dewey and Dakin, *Cycles, the Science of Prediction.* 1947. p. 64

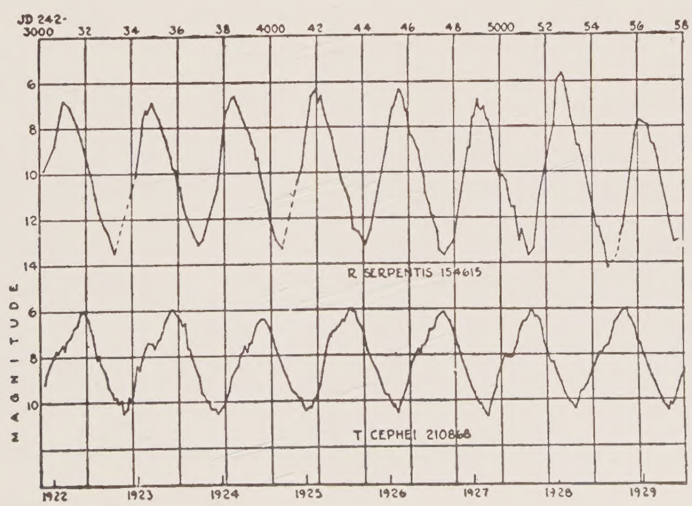


FIG. 3: VARIABLE STARS

Light curves of two long-period red giant stars. Period of R Serpentis 357.2 days, of T Cephei 387 days. (Paul W. Merrill, Mount Wilson Observatory.) Source: Skilling, W. T. and Richardson, R. S., *Astronomy,* p. 533.

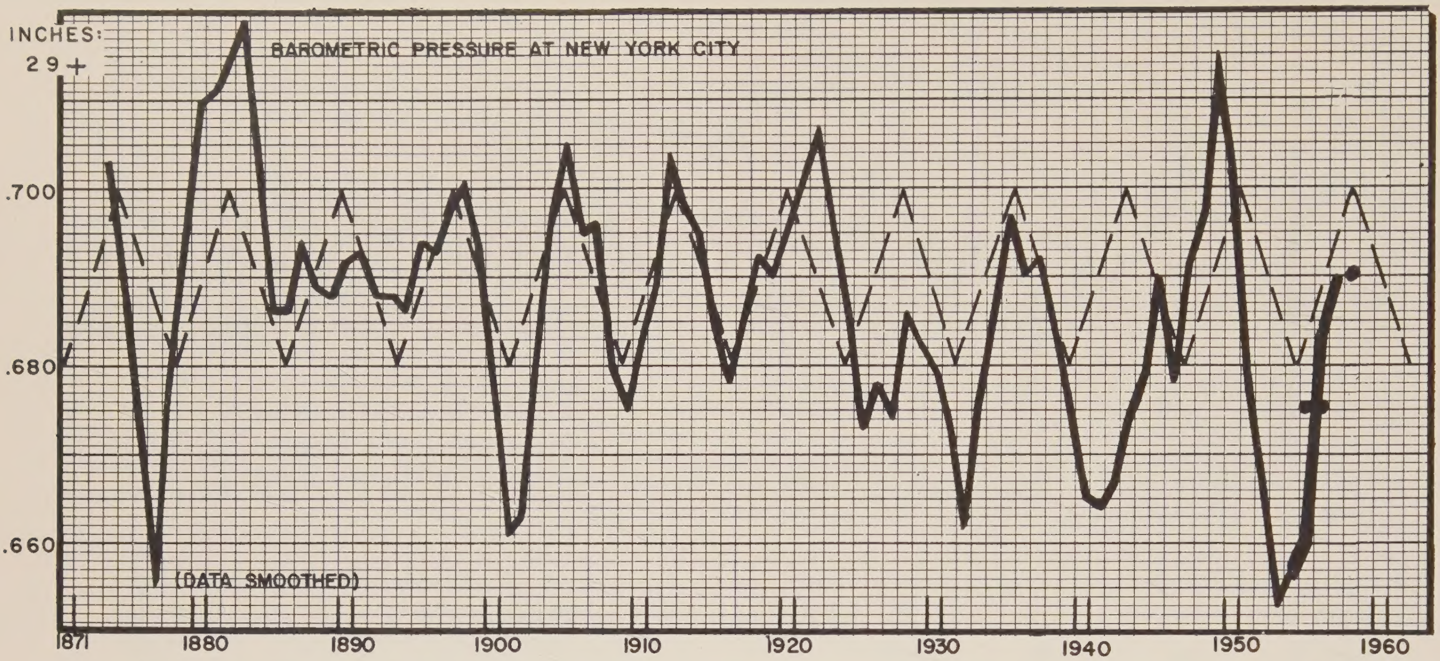


FIG. 4: BAROMETRIC PRESSURE AT NEW YORK CITY

The average annual barometric pressure at New York City, 1873—1958, smoothed by a 3-year moving average, is shown by the solid line on the chart. The latest figure is shown alone as a dot. The heavy line, 1954—1958, shows how the cycle has unfolded since discovery. Source: *Cycles*, August, 1959, p. 189.

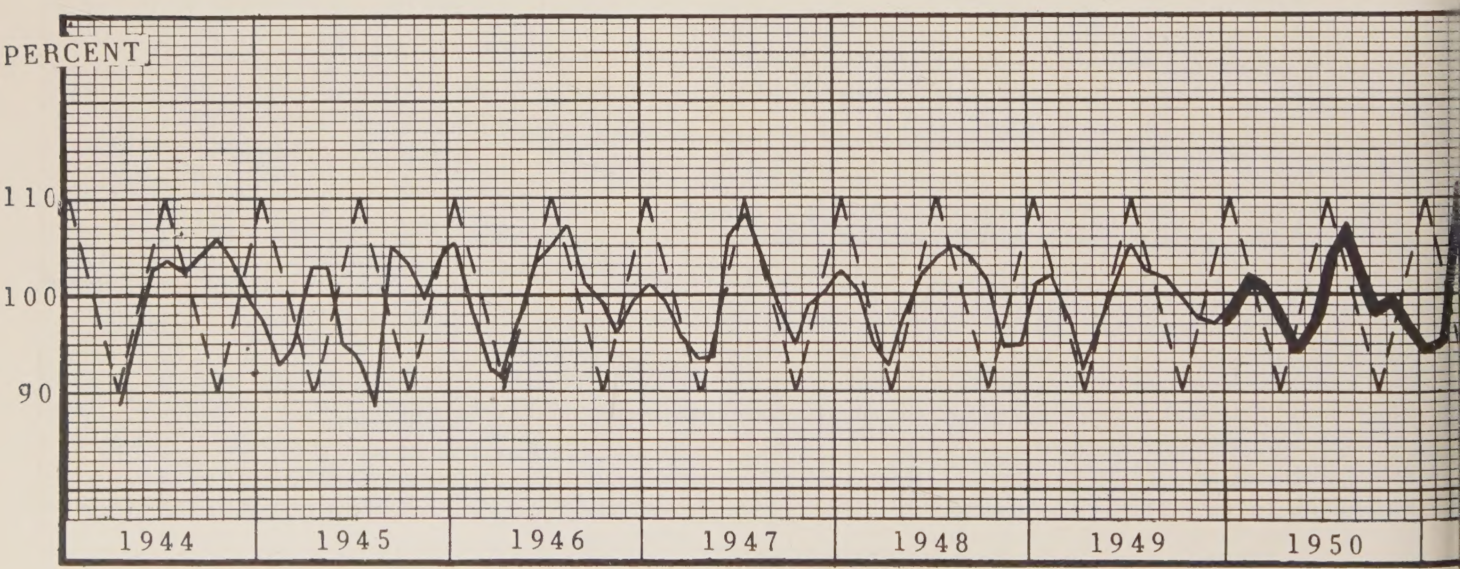


FIG. 6: THE ELECTRIC POTENTIAL OF AN OAK TREE AT NEW HAVEN 1944—1955

Voltage, smoothed by a 3-month moving average, with trend removed. The zigzag line diagrams a perfectly regular 6-month cycle. The heavy line, January, 1950 forward, shows how the cycle has unfolded since discovery.

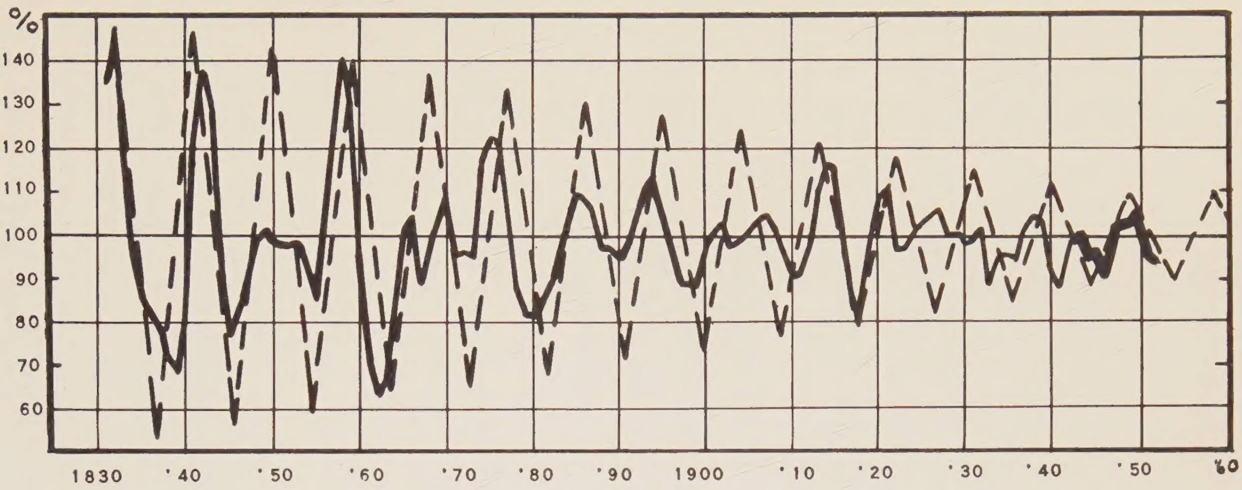
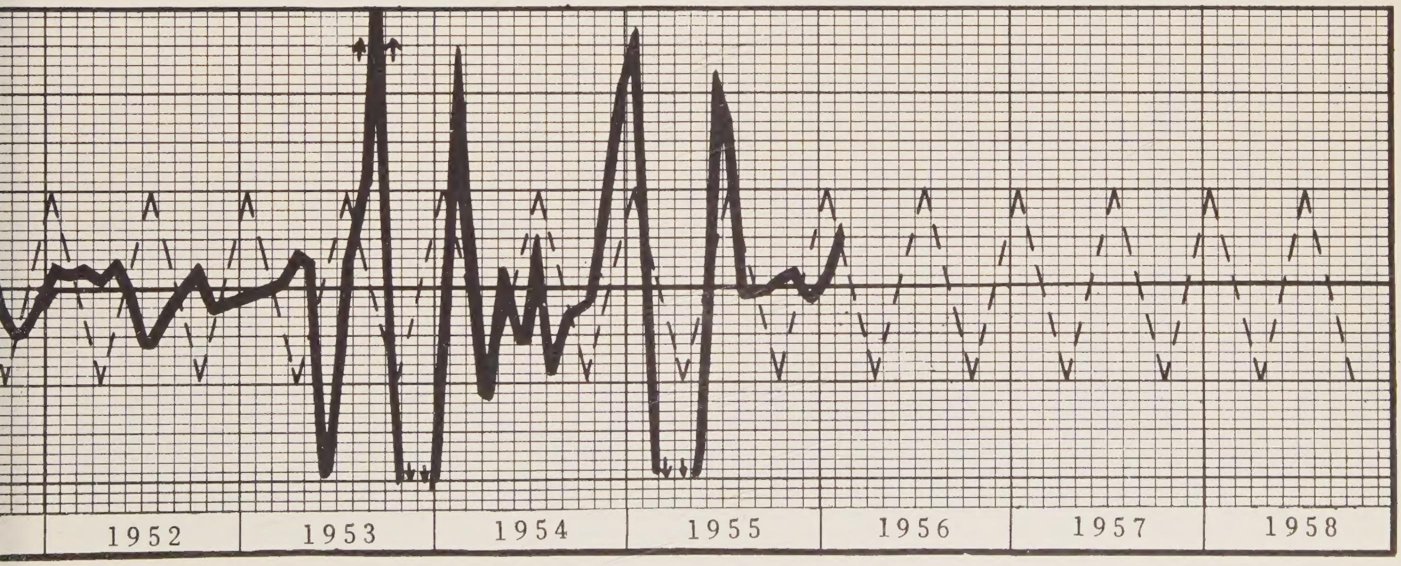


FIG. 5: NEW MEMBERS IN THE PRESBYTERIAN CHURCH

New members by profession or reaffirmation of faith, Presbyterian Church in the U. S. A. (Northern), with trend removed, 1831—1952. The curve is smoothed by a 3-year moving average. The heavy line from 1943 shows how this cycle has unfolded since discovery. The zigzag line diagrams a perfectly regular 9-year cycle. Source: *Cycles*, October, 1958, p. 261.



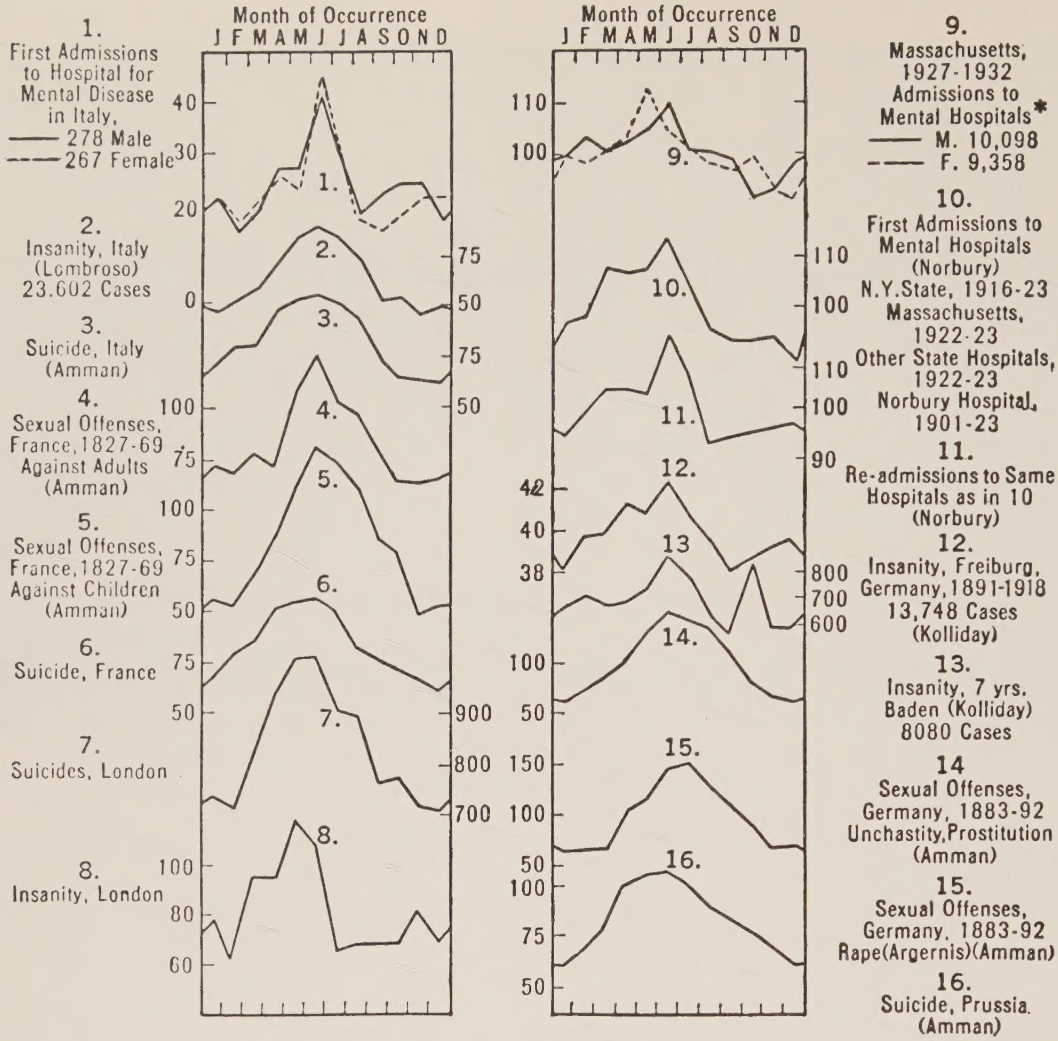


FIG. 7: SEASONAL INCIDENCE OF INSANITY, SUICIDE, AND CRIME

Source: Huntington, *Season of Birth*, p. 409.

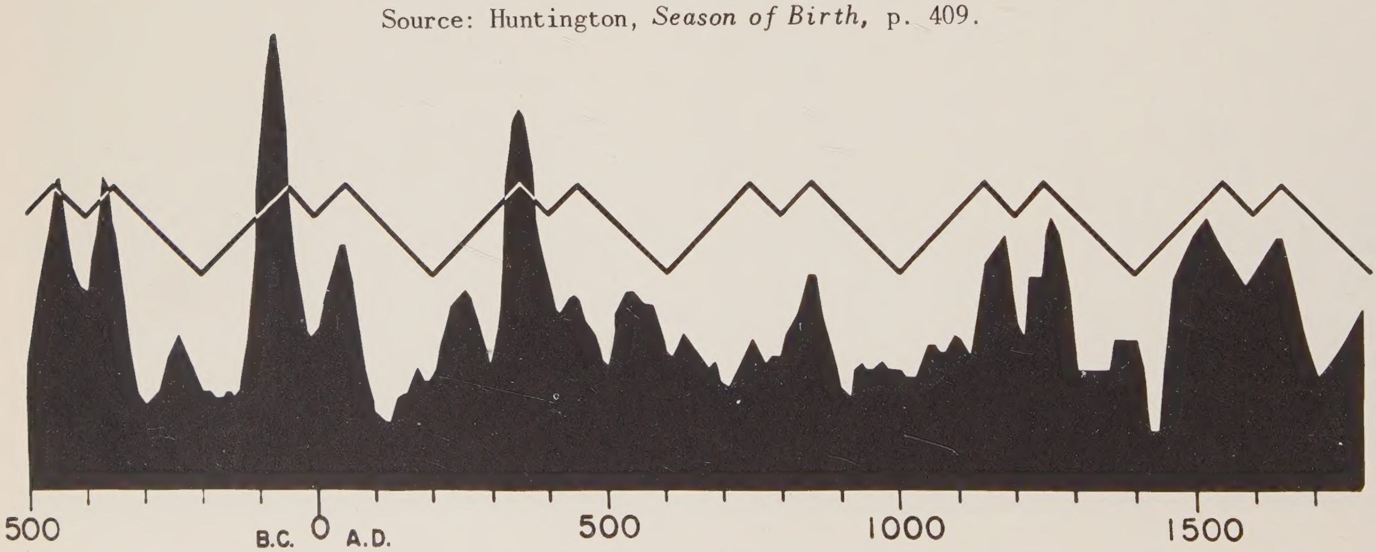


FIG. 8: THE NUMBER OF EMINENT MEN

Census of famous men and women of the Western world by decades. Names from the *Columbia Encyclopedia*. Data are plotted to the secular trend line as a base line. An ideal 400-year split-peak cycle is drawn above the data for comparison. Source: *Cycles*, April, 1954, p. 45.

Illustrations of the 9.6-Year Cycle

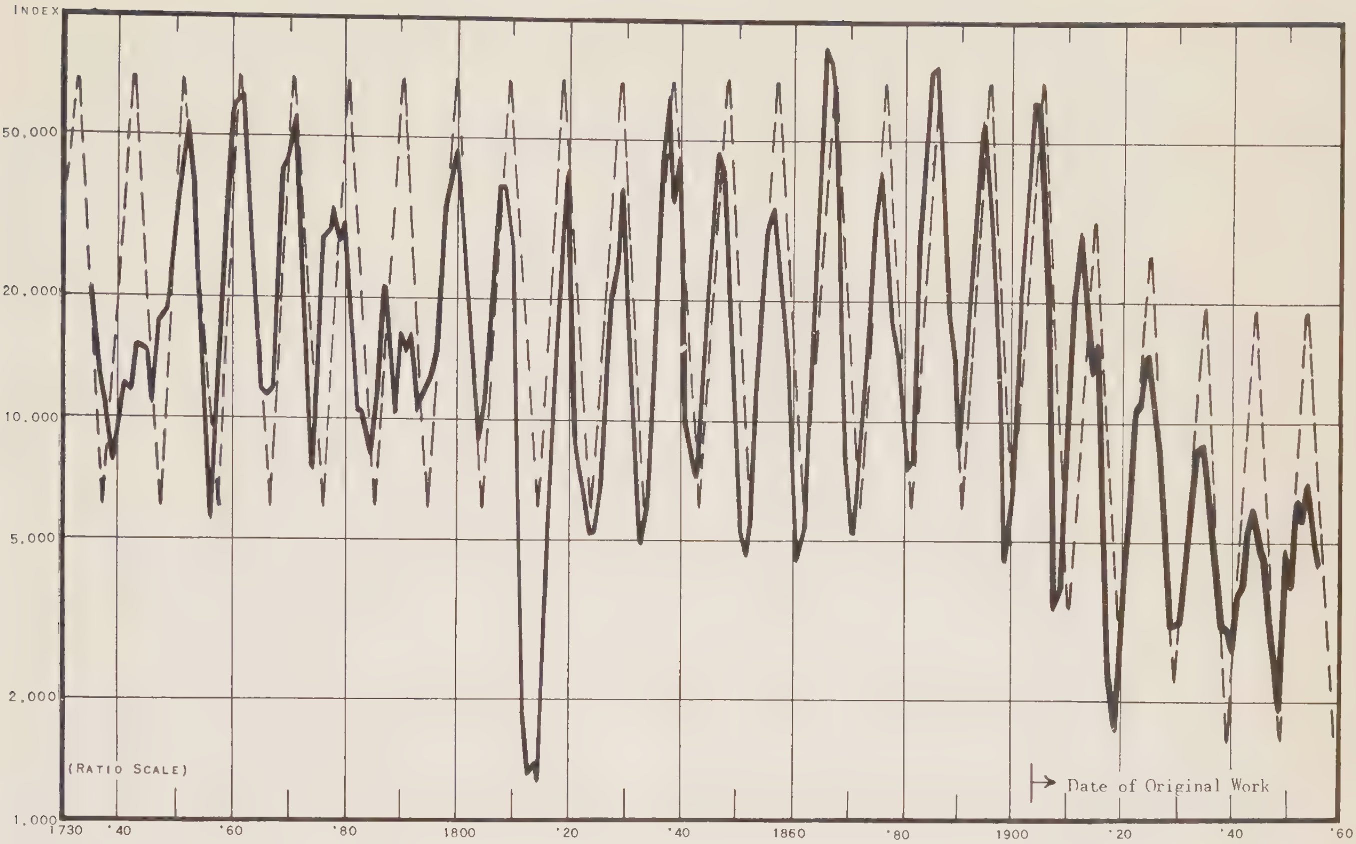


FIG. 9: THE 9.6-YEAR CYCLE IN CANADIAN LYNX

An index of the number of lynx pelts offered, 1735—1958. Early figures are from the Hudson's Bay Company and recent figures are from the Dominion Bureau of Standards. Source: *Cycles*, April, 1959, pp. 80—81.

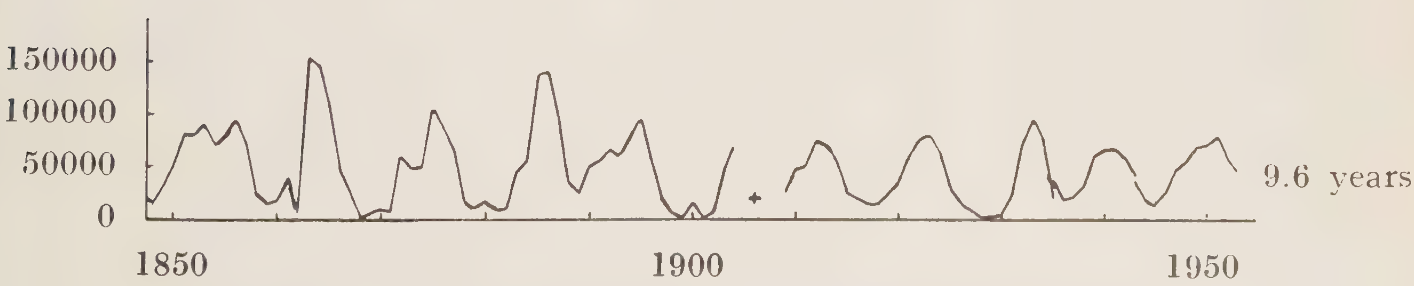


FIG. 10: THE 9.6-YEAR CYCLE OF THE VARYING HARE IN CANADA, 1849—1955

Source: Siivonen, Lauri, and Koskimies, Jukka, "Population Fluctuations and the Lunar Cycle." Published by the Finnish Game Foundation, 1955, p. 10

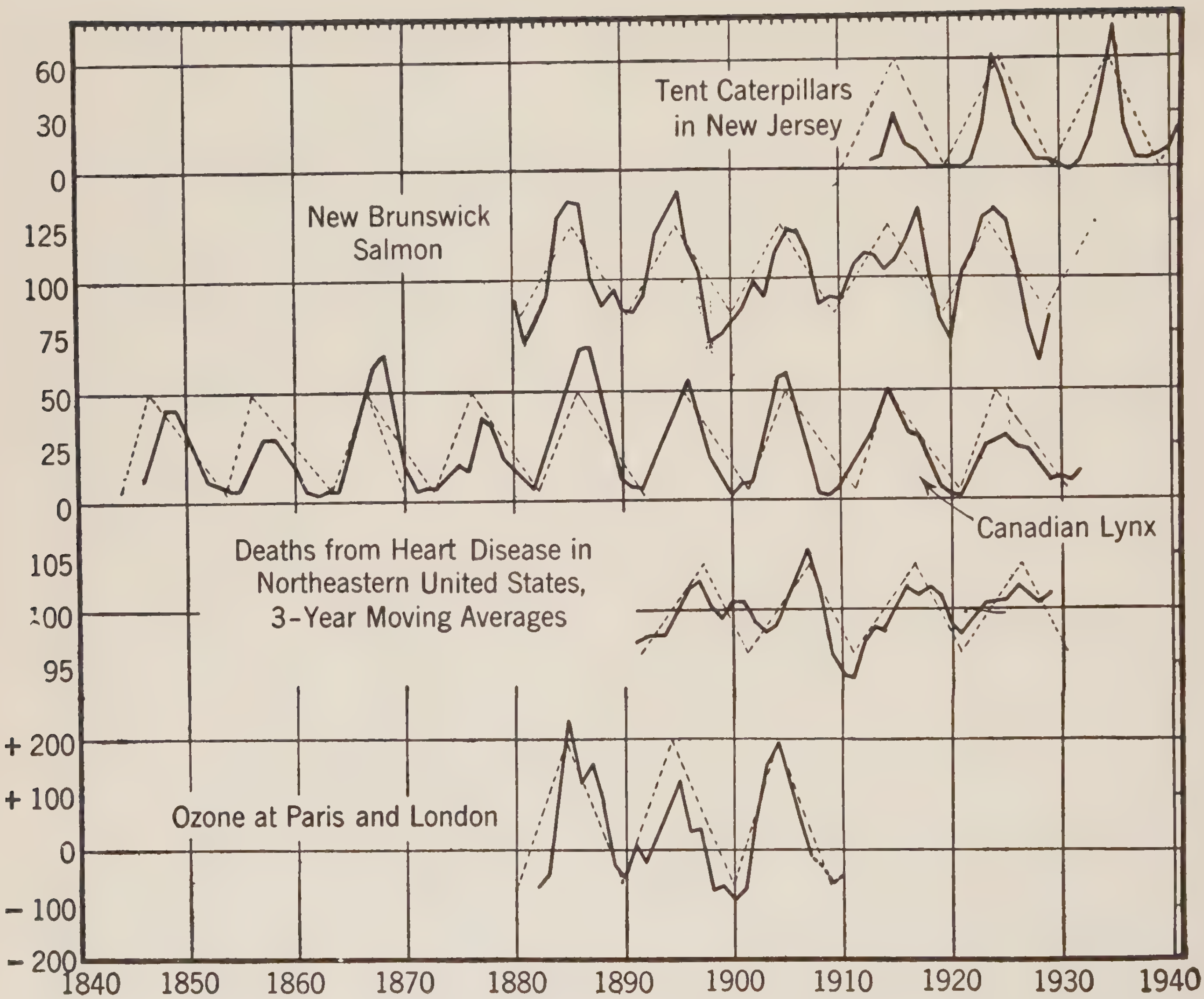


FIG. 11: THE 9.6-YEAR CYCLE IN INSECTS, FISH, MAMMALS MAN, AND OZONE

The ozone curve shows the amount by which the ozone of any given year differs from that of the fifth preceeding year, after secular trends have been eliminated. Source: Huntington, Ellsworth, *Mainsprings of Civilization*, p. 489.

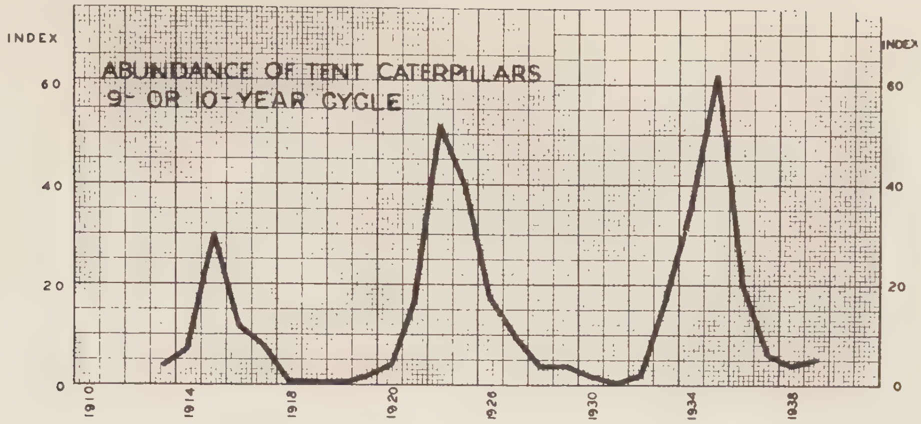


FIG. 12: THE ABUNDANCE OF TENT CATERPILLARS

Tent Caterpillars in New Jersey, 1913—1939. A cycle between nine and ten years long is indicated, but the record is too short to enable us to determine its exact length. (From Headlee.) Source: *Foundation Reprint No. 11*, 1948, p. 3.

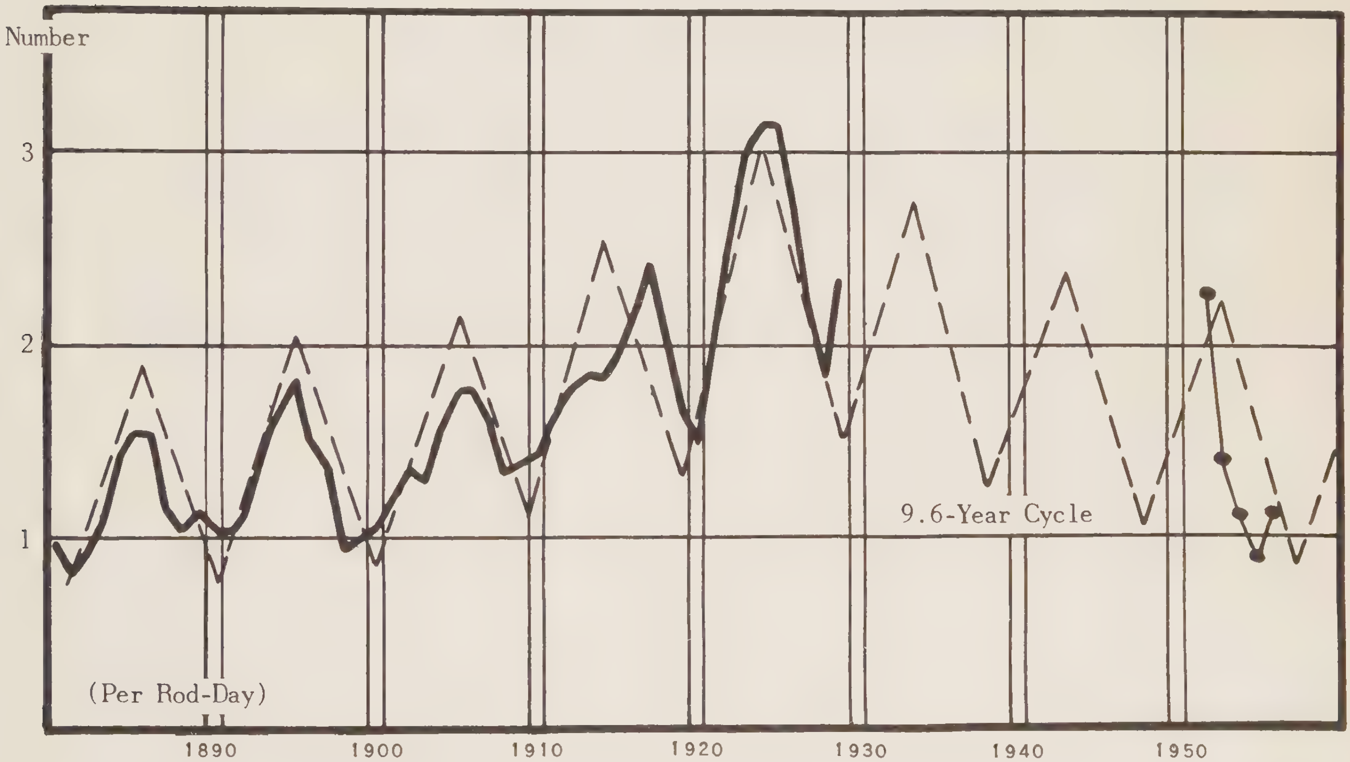


FIG. 13: THE 9.6-YEAR CYCLE IN SALMON

The above chart shows a smooth record of the per-rod-day catch of salmon by the Restigouche Salmon Club from 1880—1929, as a solid line. The broken line is the ideal 9.6-year cycle. The record for the year 1952 through 1956 is shown by the dots on the right-hand part of the chart. The intervening figures are unavailable. Source: *Cycles*, March, 1960, p. 60.

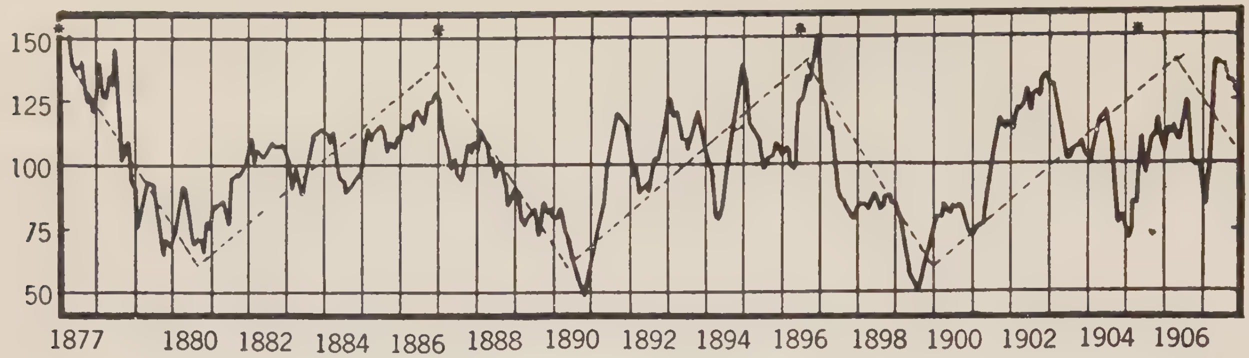


FIG. 14: THE 9.6-YEAR CYCLE OF OZONE AT LONDON (KEW) AND PARIS

In averaging the two records each of the 12 calendar months is treated as a separate unit and received the same weight at both places. Seasonal trends are eliminated by using percentages of monthly averages. Secular trends are eliminated by using percentages of a 115-month moving average. Minor variations are eliminated by means of 7-month moving averages. The four asterisks indicate maxima of lynx in Canada. Source: Huntington, Ellsworth, *Mainsprings of Civilization*, p. 494.

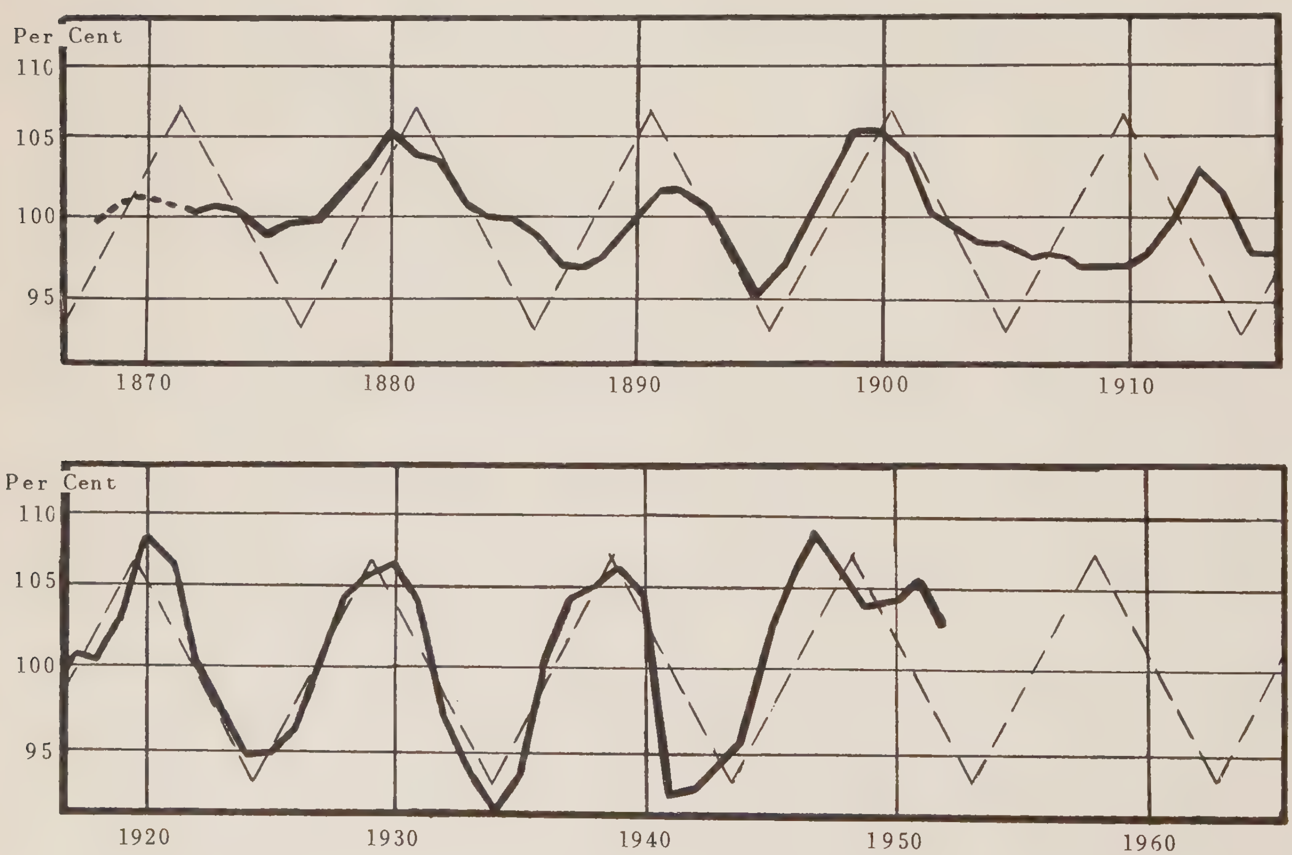


FIG. 15: THE 9.6-YEAR CYCLE IN WHEAT ACREAGE

The solid line shows percentages by which the acreage planted to wheat, 1868—1952, smoothed by a 5-year moving average, is above or below a 9-year moving average trend. The zigzag line diagrams a perfectly regular 9.6-year cycle. Ratio Scale. Source: *Cycles*, November, 1954, p. 320.

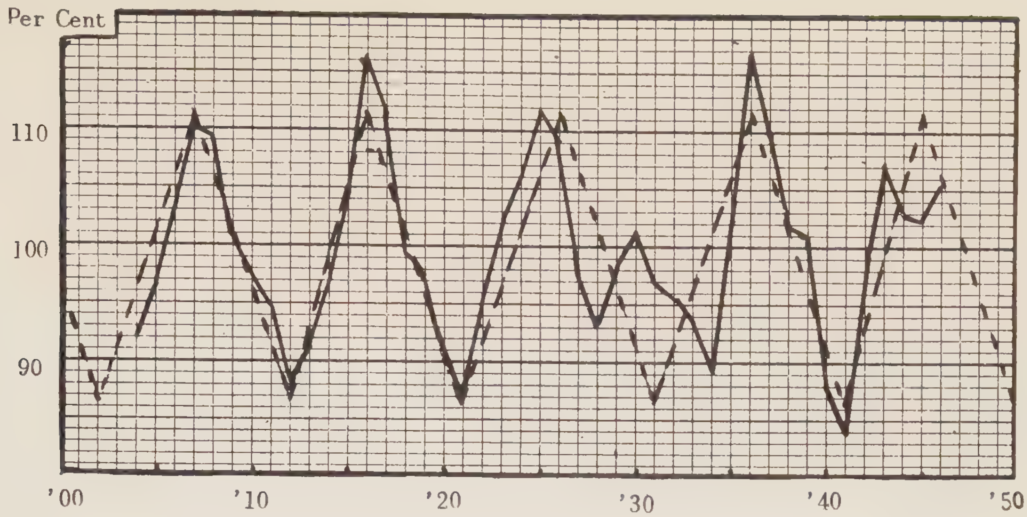


FIG. 16: THE 9.6-YEAR CYCLE IN INDIAN RAINFALL

Annual rainfall, Sone River watershed, United Provinces, India, 1903—1947, smoothed by a centered 2-year moving average. The zigzag line shows a perfectly regular 9.6-year cycle. Source: *Foundation Report No. 10,* 1950, p. 16.

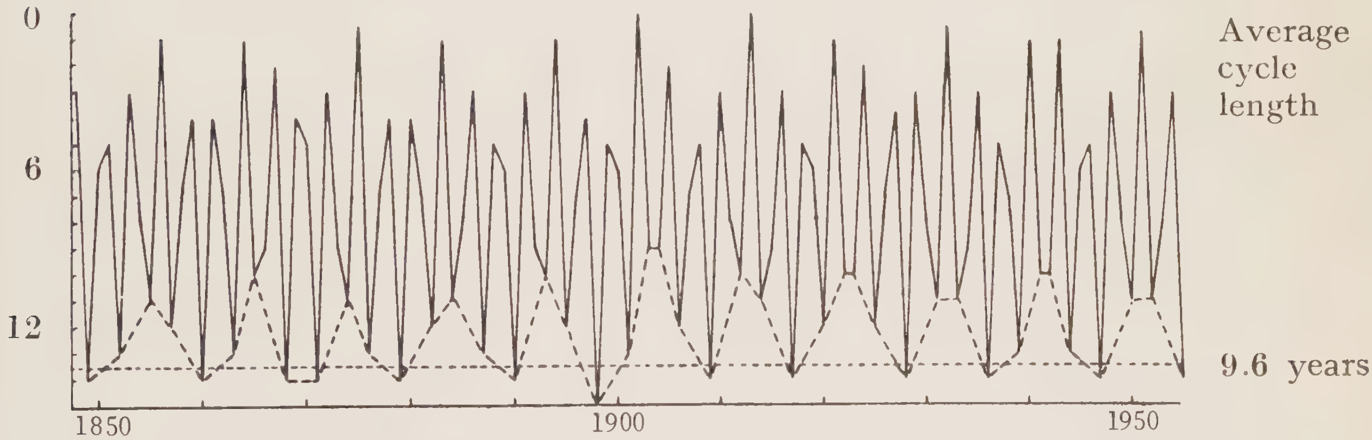


FIG. 17: THE 9.6-YEAR LUNAR CYCLE, 1849—1955

Source: Siivonen, Lauri, and Koskimies, Jukka, "Population Fluctuations and the Lunar Cycle." Published by the Finnish Game Foundation, 1955, p. 10

Illustrations of the

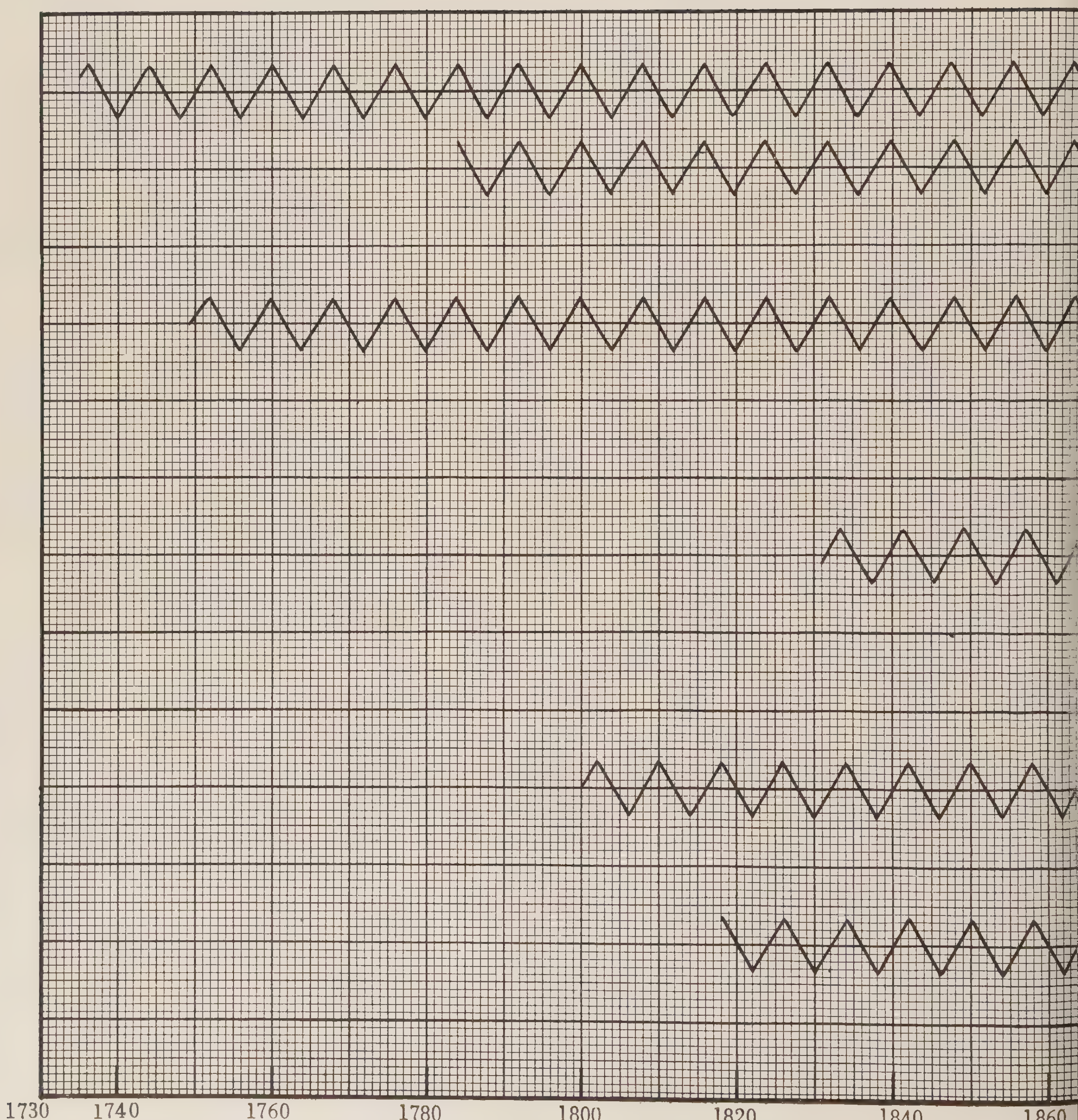


FIG. 18: DIAGRAM TO SHOW THE 8-YEAR CYCLE

Source: *Cycles*, November, 1956, pp. 310—311.

8 — Year Cycle

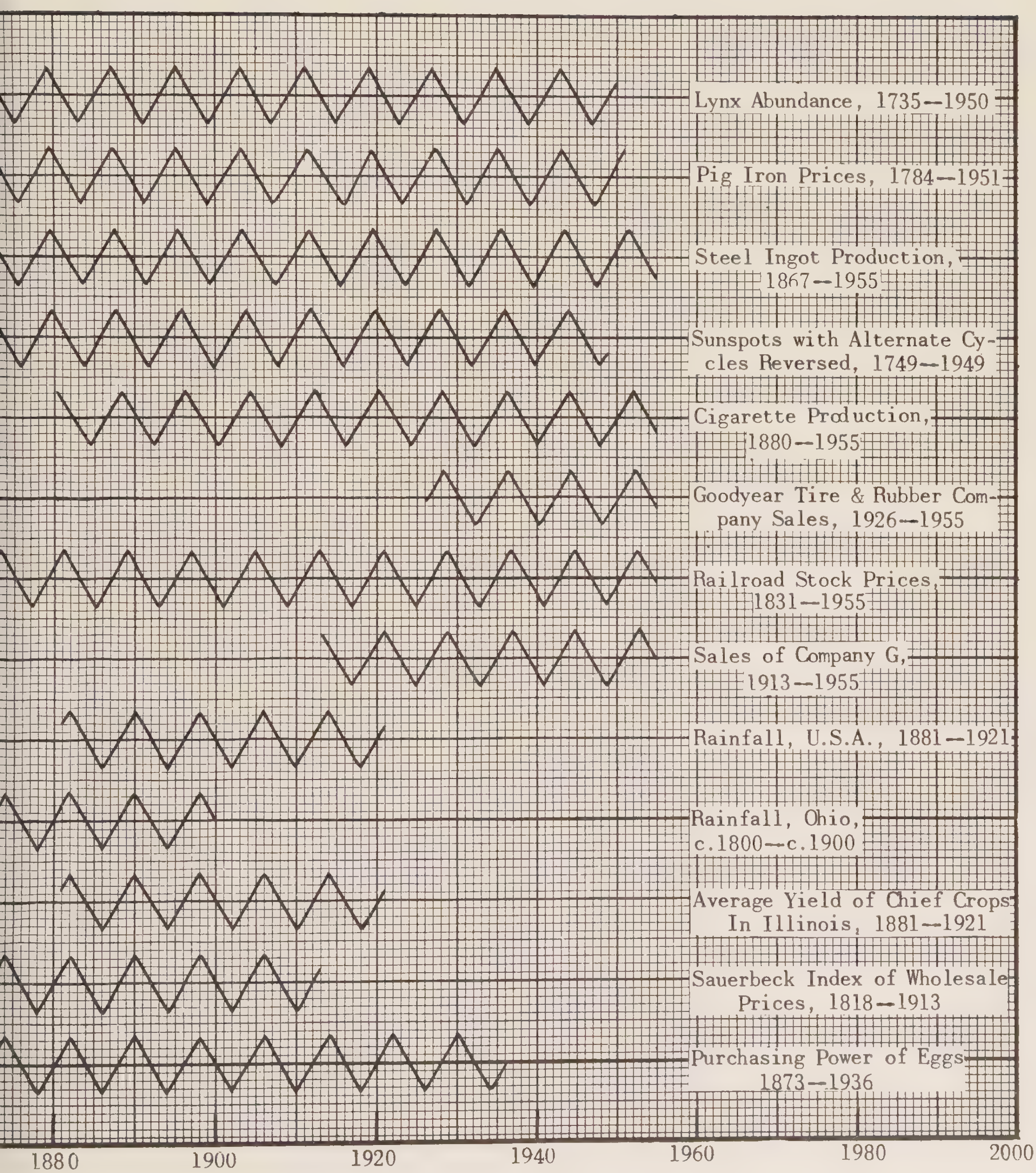

Lynx Abundance, 1735—1950
Pig Iron Prices, 1784—1951
Steel Ingot Production, 1867—1955
Sunspots with Alternate Cycles Reversed, 1749—1949
Cigarette Production, 1880—1955
Goodyear Tire & Rubber Company Sales, 1926—1955
Railroad Stock Prices, 1831—1955
Sales of Company G, 1913—1955
Rainfall, U.S.A., 1881—1921
Rainfall, Ohio, c.1800—c.1900
Average Yield of Chief Crops In Illinois, 1881—1921
Sauerbeck Index of Wholesale Prices, 1818—1913
Purchasing Power of Eggs 1873—1936
1880
1900
1920
1940
1960
1980
2000

TABLE 1

SUMMARY

8-Year (7.95-Year) Cycle

Ref.	Phenomena	Span of Years	Cycle Length (Preliminary Estimate)	Time of Current Crest	Strength (% above Trend at Crest)
1	Lynx Abundance (Secondary Cycle), 1735—1950	216	7.95	1951.25	22.7%
2	Pig Iron Prices, 1784—1951	168	7.95	1951.5	medium
3	Steel Ingot Production, 1867—1955	89	8.0	1952.0	medium
4	Sunspots with Alternate Cycles Reversed, 1749—1949	201	8.0	1952.3	2.4 index
5	Cigarette Production, 1880—1955	76	7.95	1952.5	6%
6	Goodyear Sales, 1926—1955	30	8.	1952.75	24.4%
7	Rail Stock Prices, 1831—1955	125	*7.95	1952.9	2%
8	Sales of Company G, 1913—1955	43	8.0	1953.25	weak
9	Cotton Prices, 1735—1945	215	7.95	u	strong
10	Rainfall, U. S. A., 1881—1921	41	8.0	1954	medium
11	Rainfall, Ohio, c.1800—c.1900	c.100	8.0	1954	u
12	Average Yield of Chief Crop, 1881—1921	41	8.0	1954	u
13	Abundance of Ptarmigan	u	8	u	u
10	Sauerbeck Index of Wholesale Prices, 1818—1913	96	8.	1954p	u
14	Purchasing Power of Eggs, 1873—1936	64	8.	1954	weak
15	Wheat Prices, Chicago, 1884—1930	47	8.	u	u

u represents unknown. p represents probably c. represents *circa* (about)

*Not to be confused with the 8.17-year cycle in the Combined Stock Index.

Source: *Cycles*, October, 1956, p. 272.

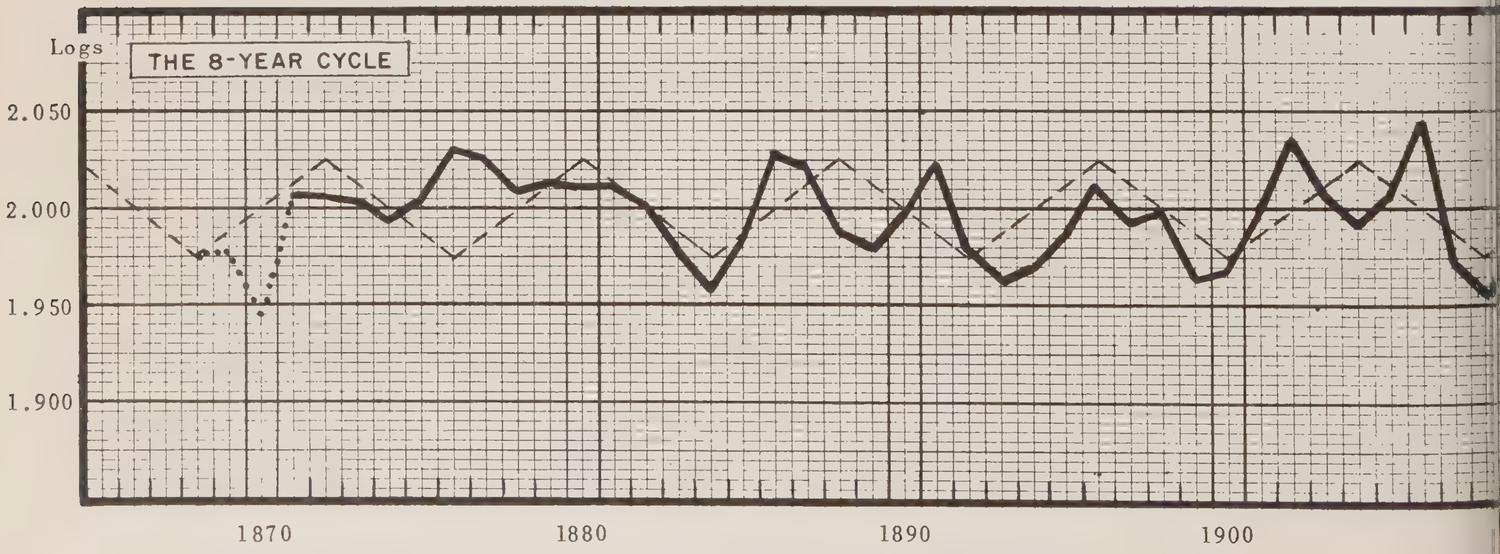


FIG. 20: STEEL INGOTS AND CASTINGS, 1868—1953

A 3-year moving average of the deviations from a 6-year moving average (less the 6- and 9-year cycles). The zigzag line diagrams a perfectly regular 8-year cycle.

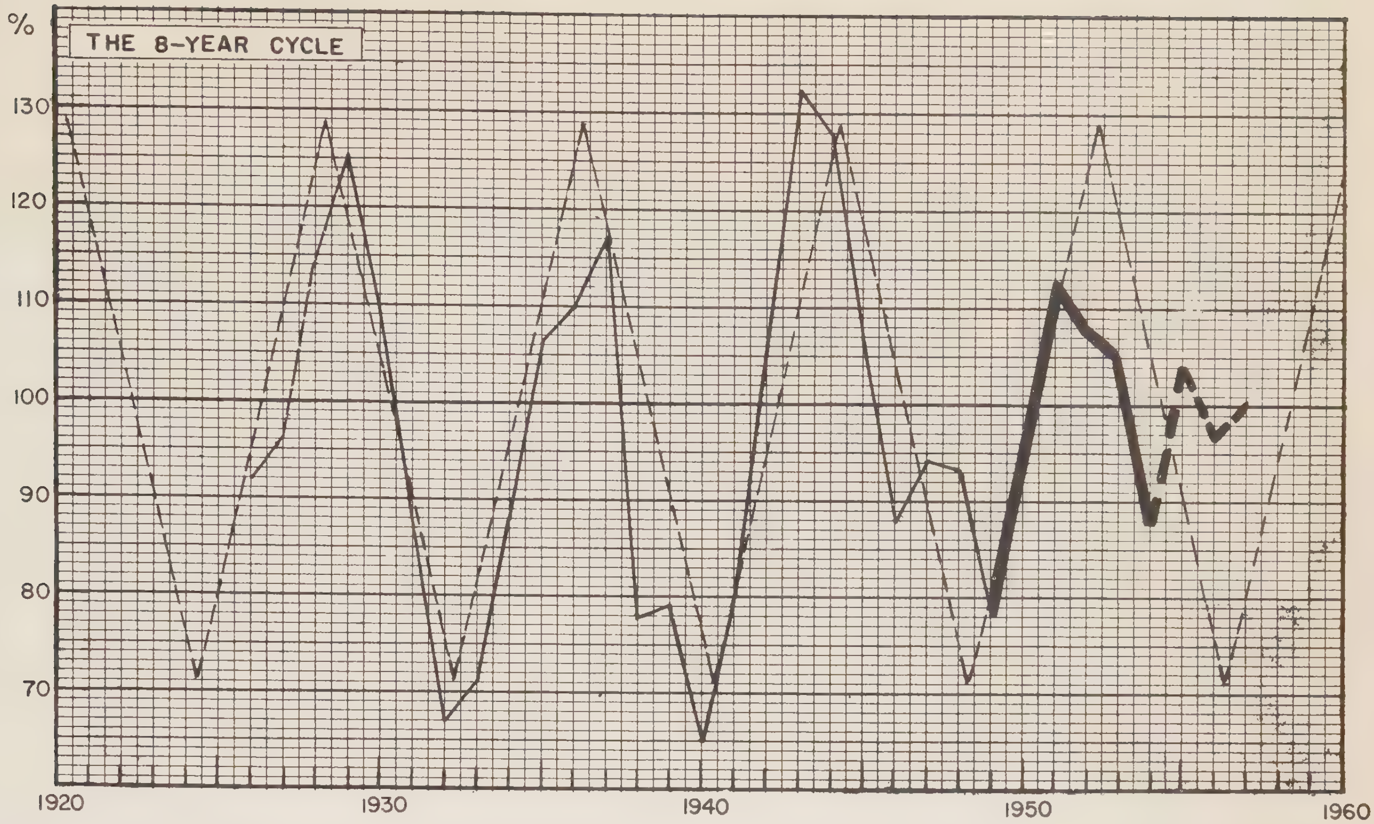
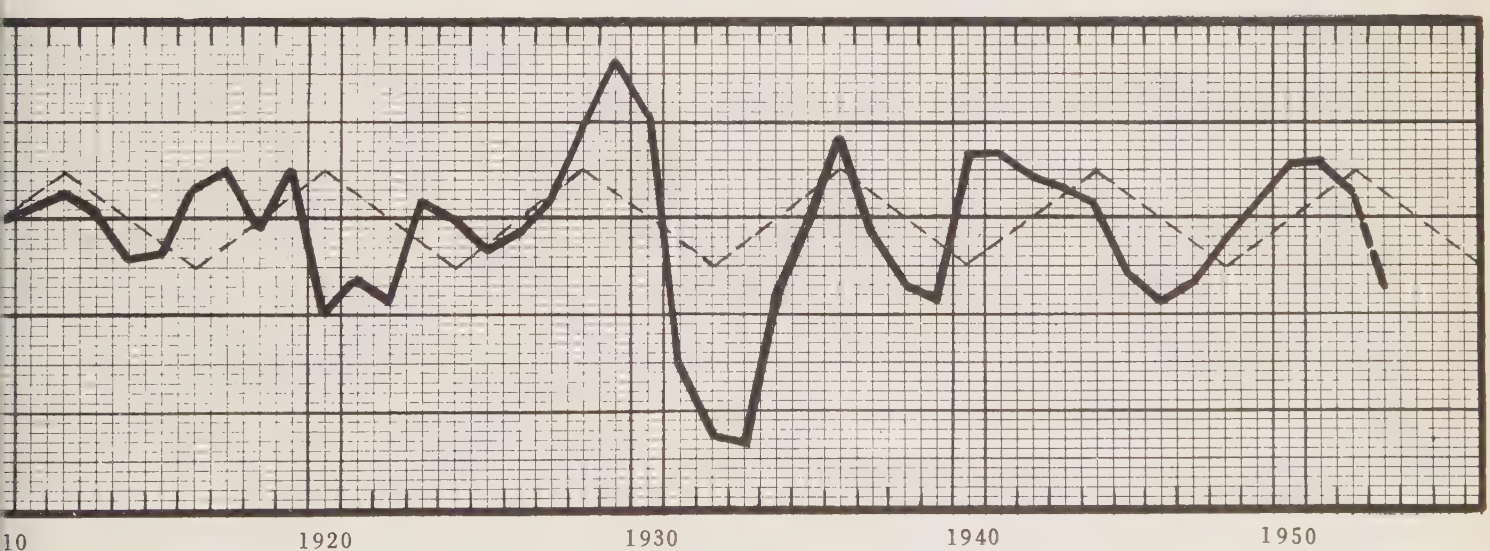


FIG. 19: GOODYEAR TIRE AND RUBBER NET SALES, 1926—1957

The solid line shows the percentages that sales are of trend. The heavy line shows how the cycle has unfolded since discovery. The zigzag line diagrams a perfectly regular 8-year cycle. Source: *Cycles*, April, 1958, p. 103.



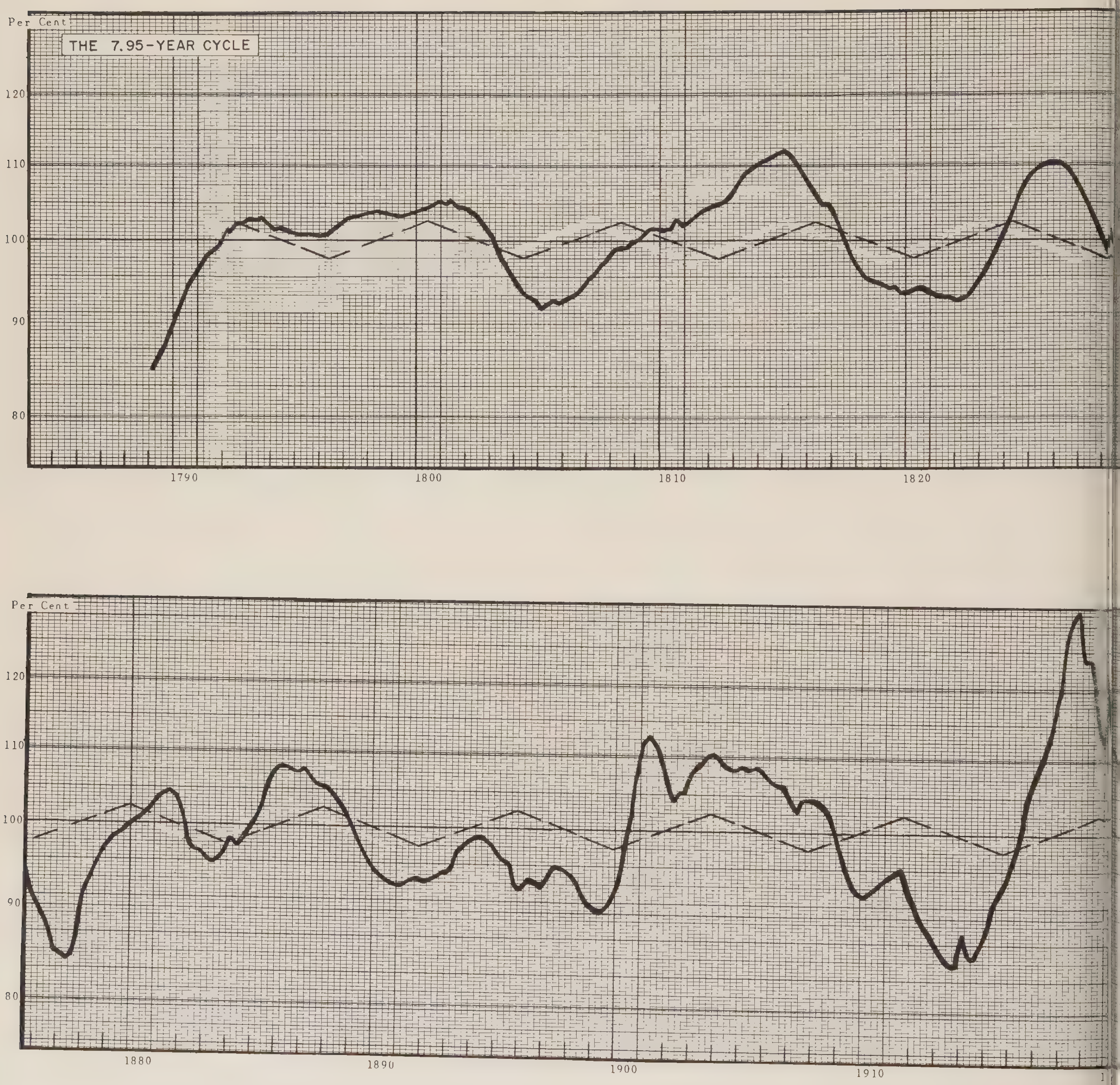
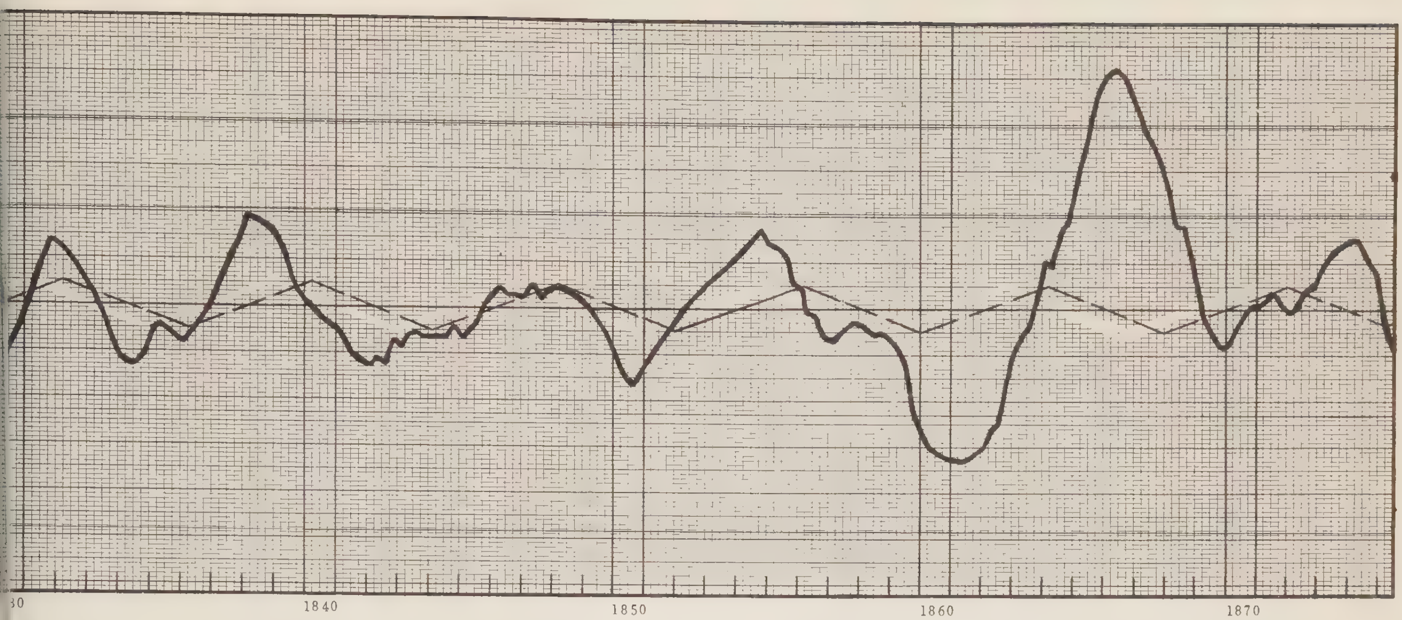
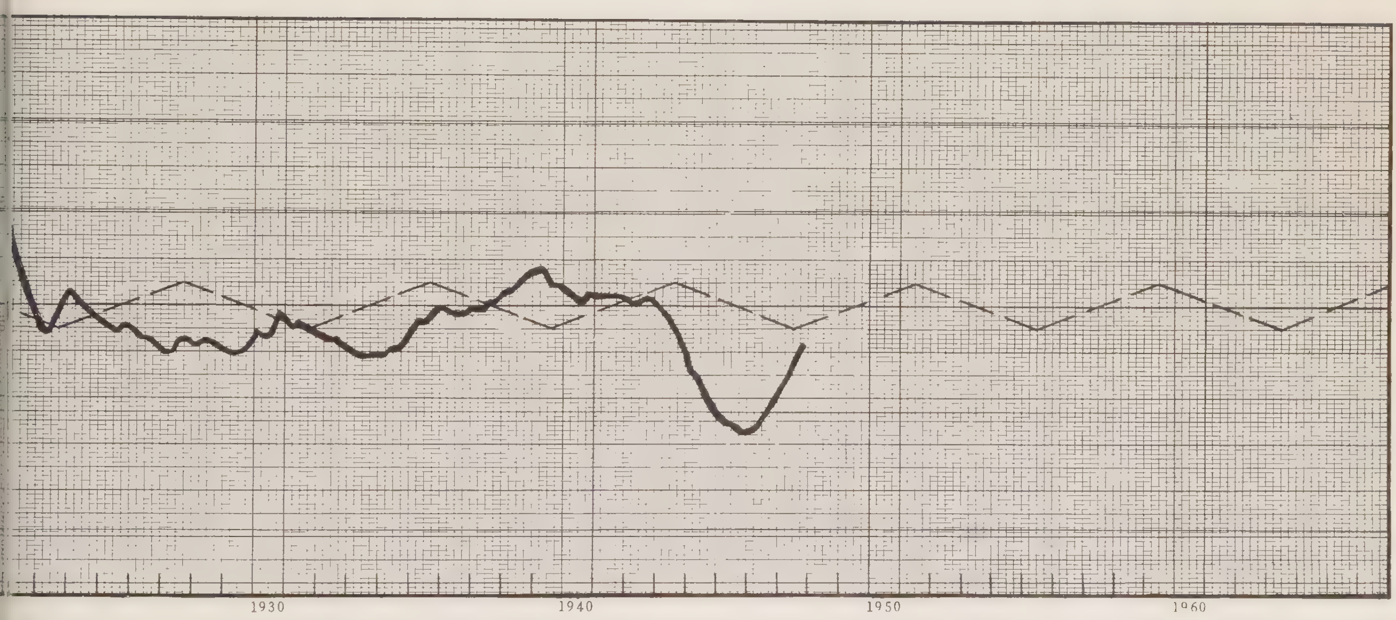


FIG. 21: PIG IRON PRICES, 1789—1948

Deviations of the 17-quarter moving average of the logs of the data (less the 9.2-, 8.5-, and 5.91-year cycles) from the 41-quarter moving average of the logs of the data. The zigzag line diagrams a perfectly regular 7.95-year cycle.


30
1840
1850
1860
1870


1930
1940
1950
1960

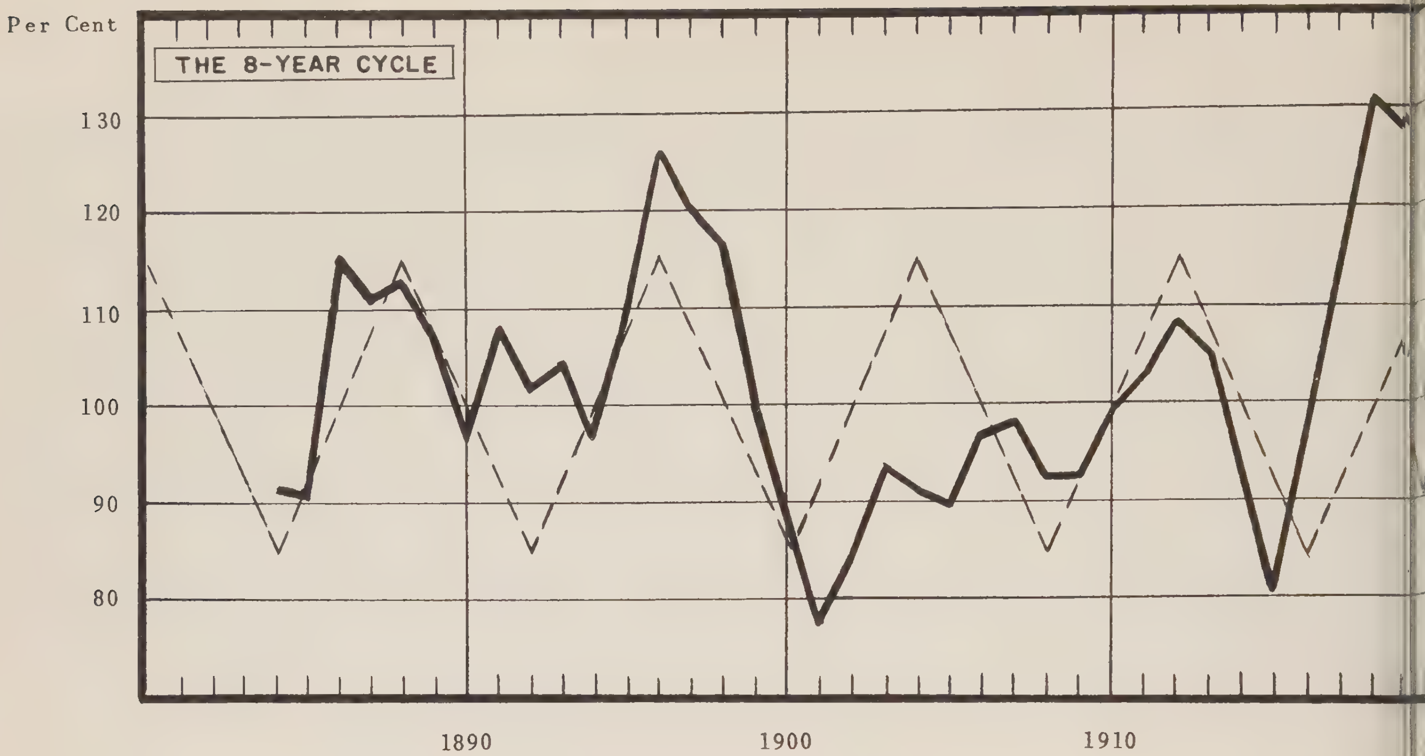


FIG. 22: CIGARETTE PRODUCTION, 1884—1953

The annual production expressed as a percentage of the 9-year moving average trend. The zigzag line diagrams a perfectly regular 8-year cycle. Source: *Cycles,* October, 1956, p. 277.

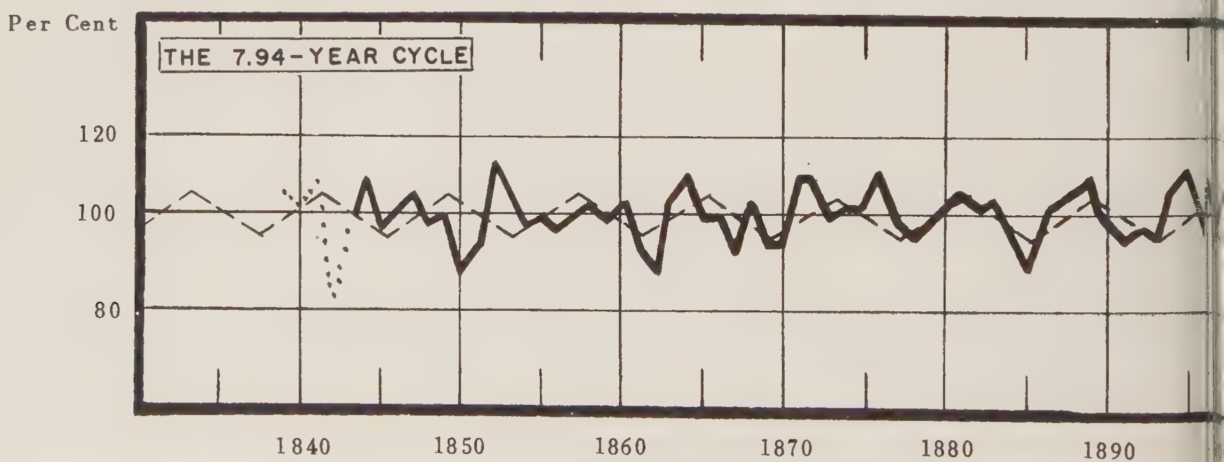
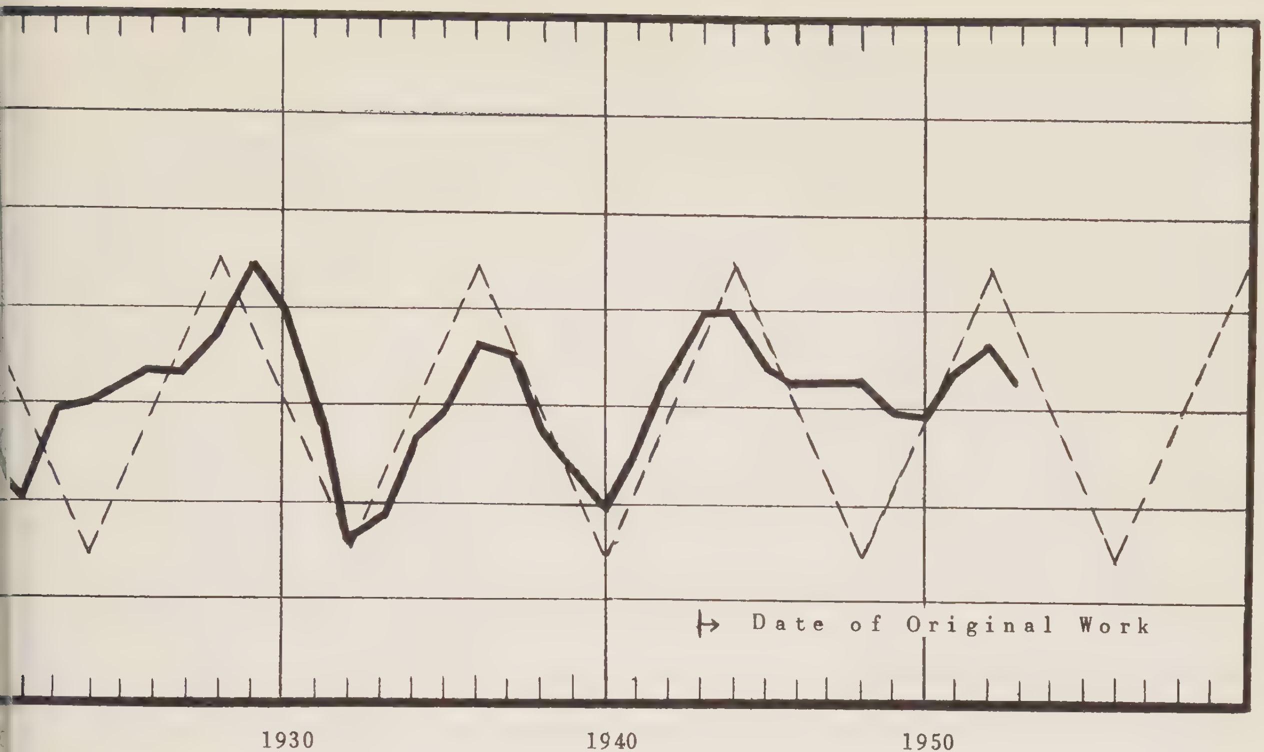
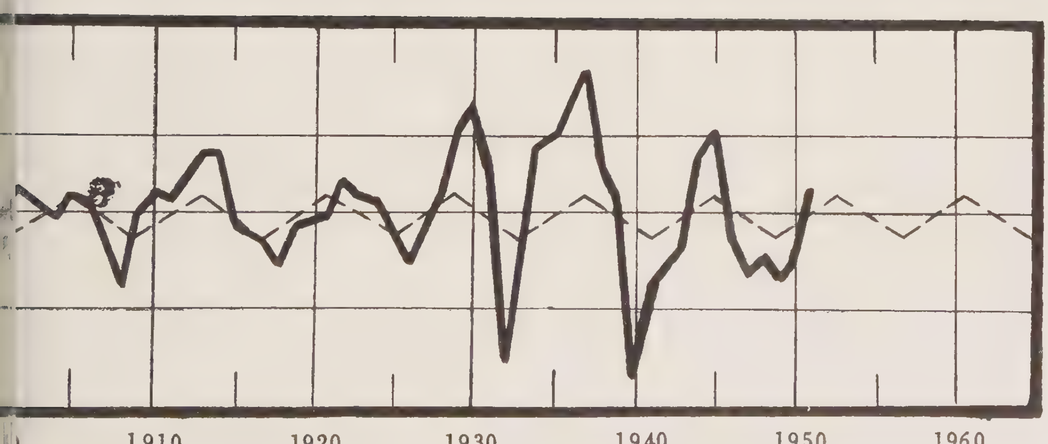


FIG. 23: RAILROAD STOCK PRICES, 1839—1951

Deviations from a 9-year trend adjusted for the 9.18-year cycle, smoothed by a two 8-section moving average. The zigzag line diagrams a perfectly regular 7.94-year cycle. Source: *Cycles,* November, 1956, p. 292—293.


Date of Original Work
1930
1940
1950


1910
1920
1930
1940
1950
1960

Illustrations of th

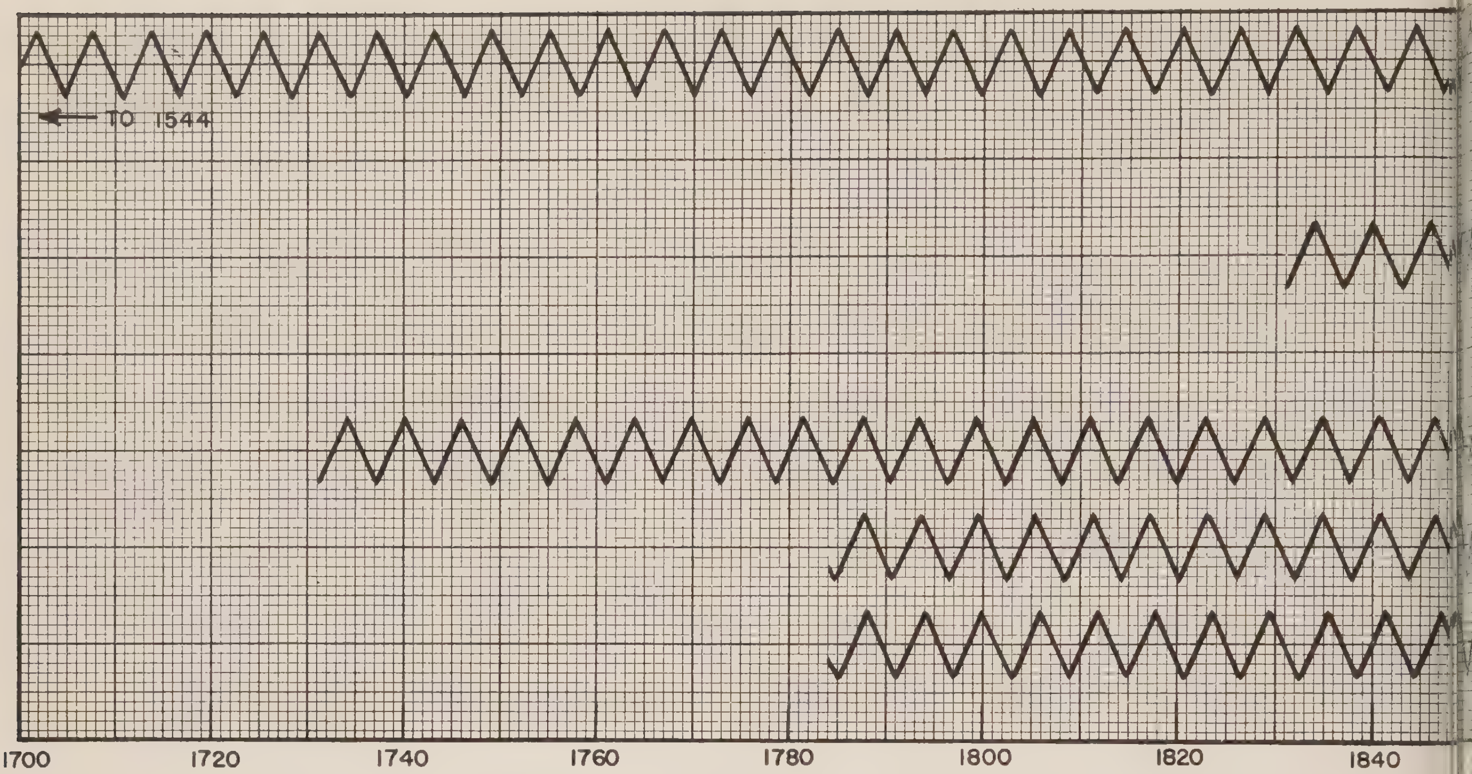


FIG. 24: DIAGRAM TO SHOW THE 5.91-YEAR CYCLE

This diagram illustrates the timing of the 5.91-year cycle in various phenomena, and the length of the series of figures in which it has been observed. The fact that the cycle in the tree rings at Fairlee, Vermont, has a slightly different length and comes at a slightly different time suggests that it is probably a different cycle. Source: *Cycles,* January, 1957, pp. 18—19.

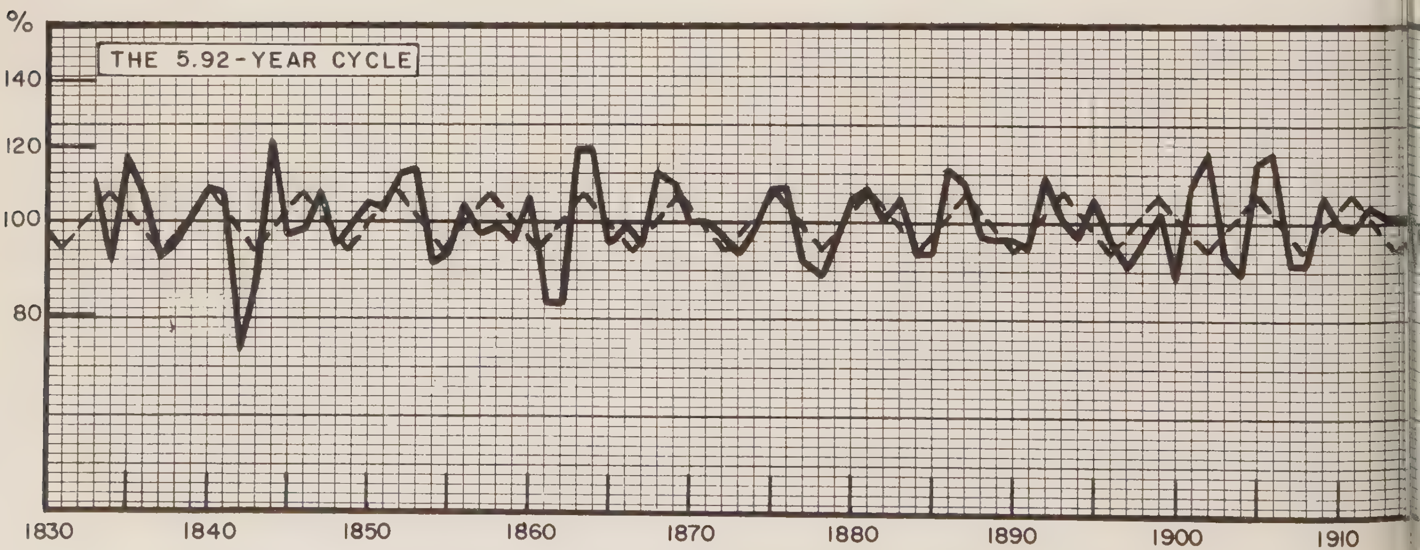
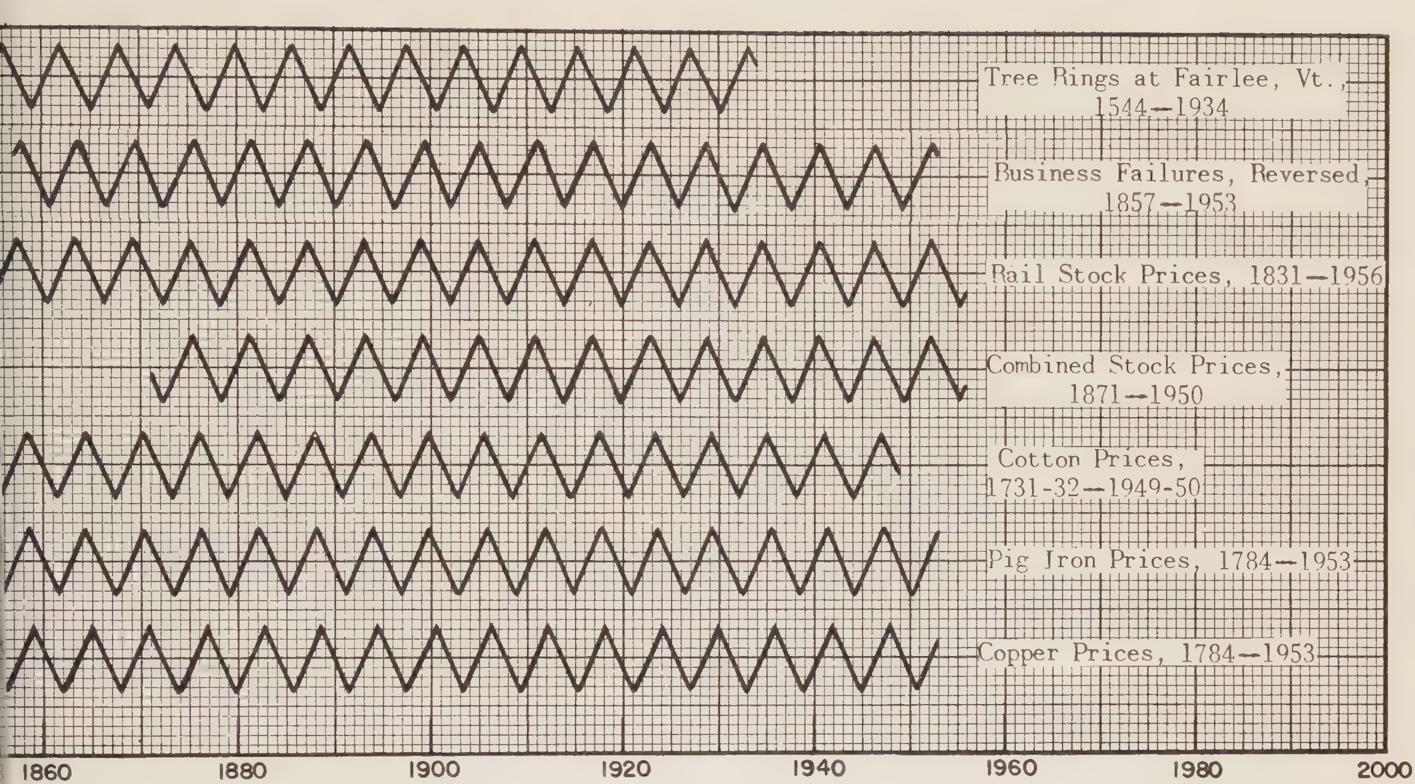


FIG. 25: RAILROAD STOCK PRICES, 1833—1954

Deviations of the data (adjusted for the 9.18-, 7.94-, and 8.39-year cycles) from their 5-year moving average. Deviations are expressed as a percentage of trend which is level at 100%. The zigzag line diagrams a perfectly regular 5.92-year cycle. Ratio Scale. Source: *Cycles,* April, 1957, pp. 96—97.

5.91 — Year Cycle



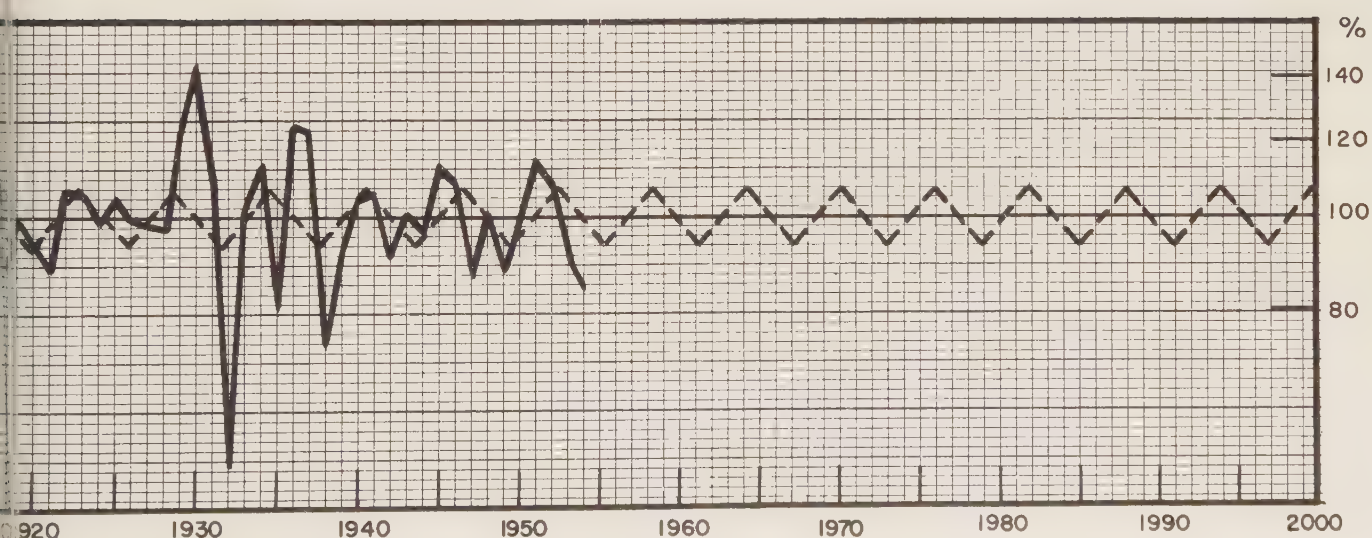


TABLE 2

SUMMARY

5.91-Year Cycle

Ref.	Phenomena	Span of Years	Cycle Length	Time of Current Crest	Strength vs. Trend Above	Below
					Index of 1	
1	Sunspots, with Alternate Cycles Reversed, 1749—1937	189	5.90	1955.61		
2	Tree Rings at Fairlee, Vermont, 1544—1934	391	5.933	1957.35	u	u
3	Liabilities of Business Failures, 1857—1953	97	5.9	*1958.65	12.5	11.1
4	Index of Railroad Stock Prices, 1831—1956	126	5.92	1958.68	8.6	8.0
5	Combined Index of Stock Prices, 1871—1956	86	5.91	1958.69	6.4	6.0
6	Cotton Prices, 1731-32—1949-50	219	5.91	1959.28	6.7	6.2
7	Pig Iron Prices, 1784—1953	170	5.91	1959.525	5.5	5.1
8	Copper Prices, 1784—1953	170	5.91	1959.89	5.6	5.3
9	European Wheat Prices	300	5.96	u	u	u
10	Barometric Pressure in Batavia, 1866—1940	75	5.97	u	u	u
11	Index of Industrial Stock Prices, 1871—1950	80	5.93	u	u	u
12	One half Siderial Period of Jupiter	—	5.931	u	u	u
12	One fifth Sidereal Period of Saturn	—	5.892	u	u	u
12	One forty-second of the Sidereal Period of Pluto	—	5.915	u	u	u

* trough

u unknown

Source: *Cycles*, April, 1957, p. 101.

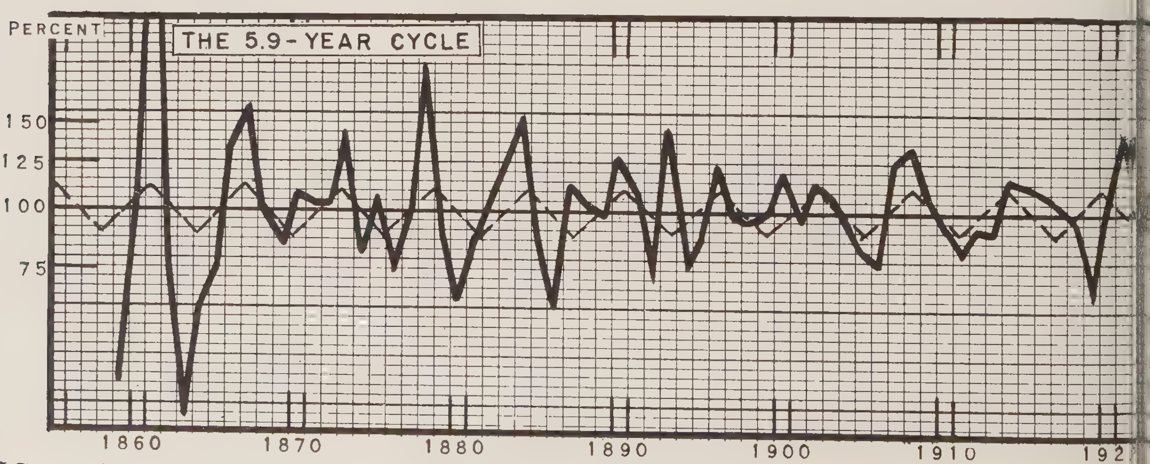


FIG. 26: BUSINESS FAILURES, 1859—1954

Percentages that the data, adjusted for the 17.75-, 9.2-, and 3.42-year cycles, are of the 5-year moving averages of these figures. Heavy line, 1950—1954, shows how the cycle has unfolded since discovery. The zigzag line diagrams a perfectly regular 5.9-year cycle. Source: *Cycles*, May, 1957, pp. 134—135.

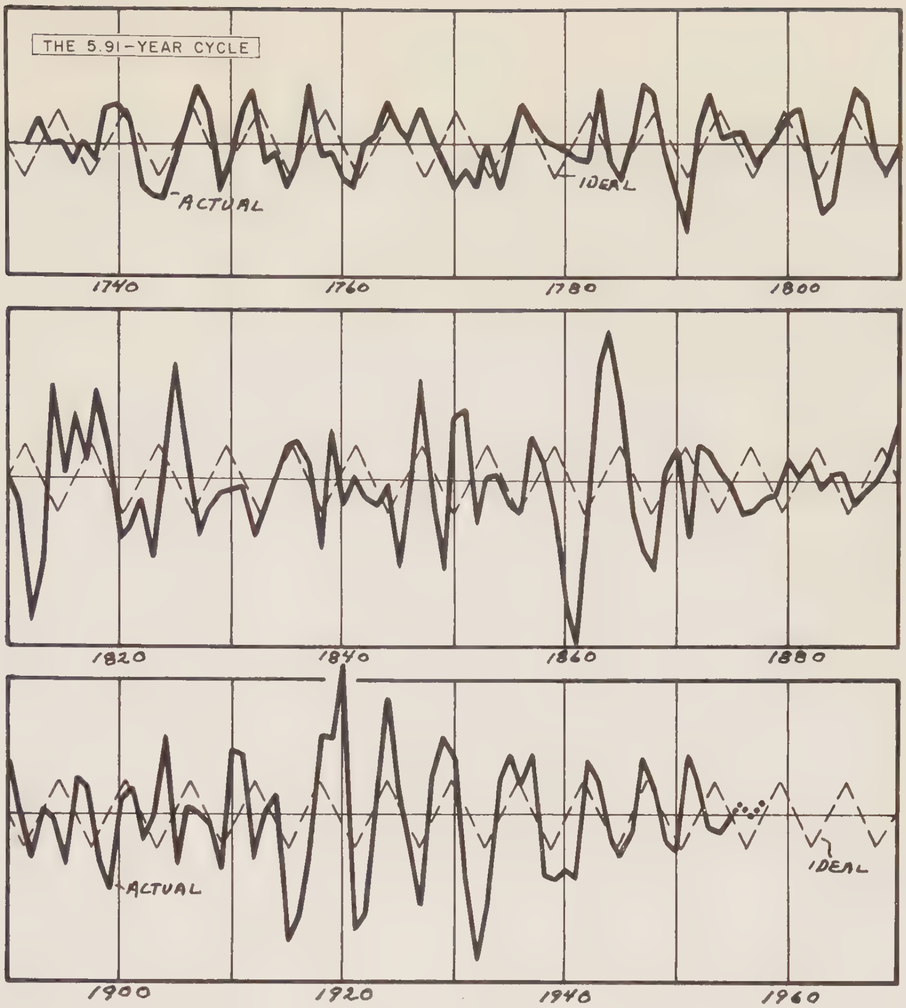
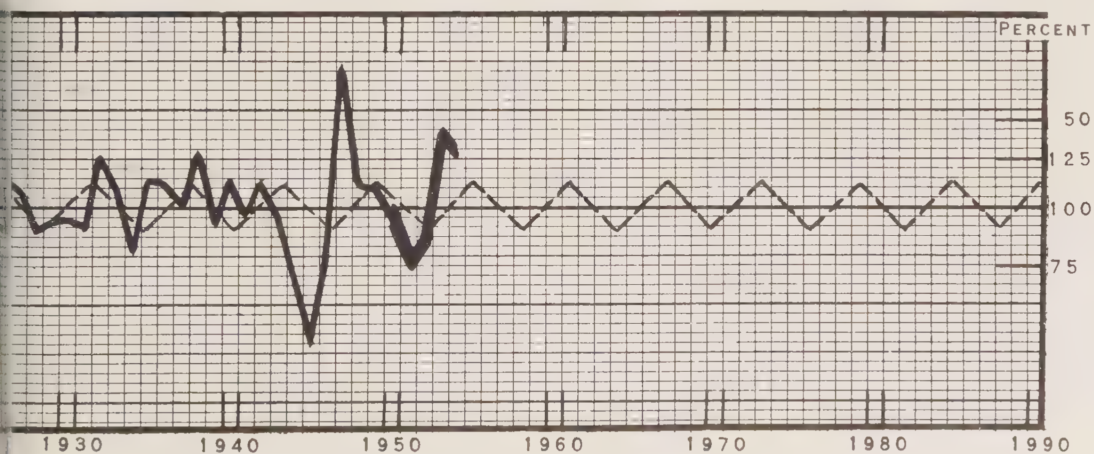


FIG. 27: COTTON PRICES, 1732—1958

Actual cotton prices expressed as percentages above and below trend. The zigzag line diagrams a perfectly regular 5.91-year cycle. Source: *Cycles*, February, 1959, p. 30.



Illustrations of the

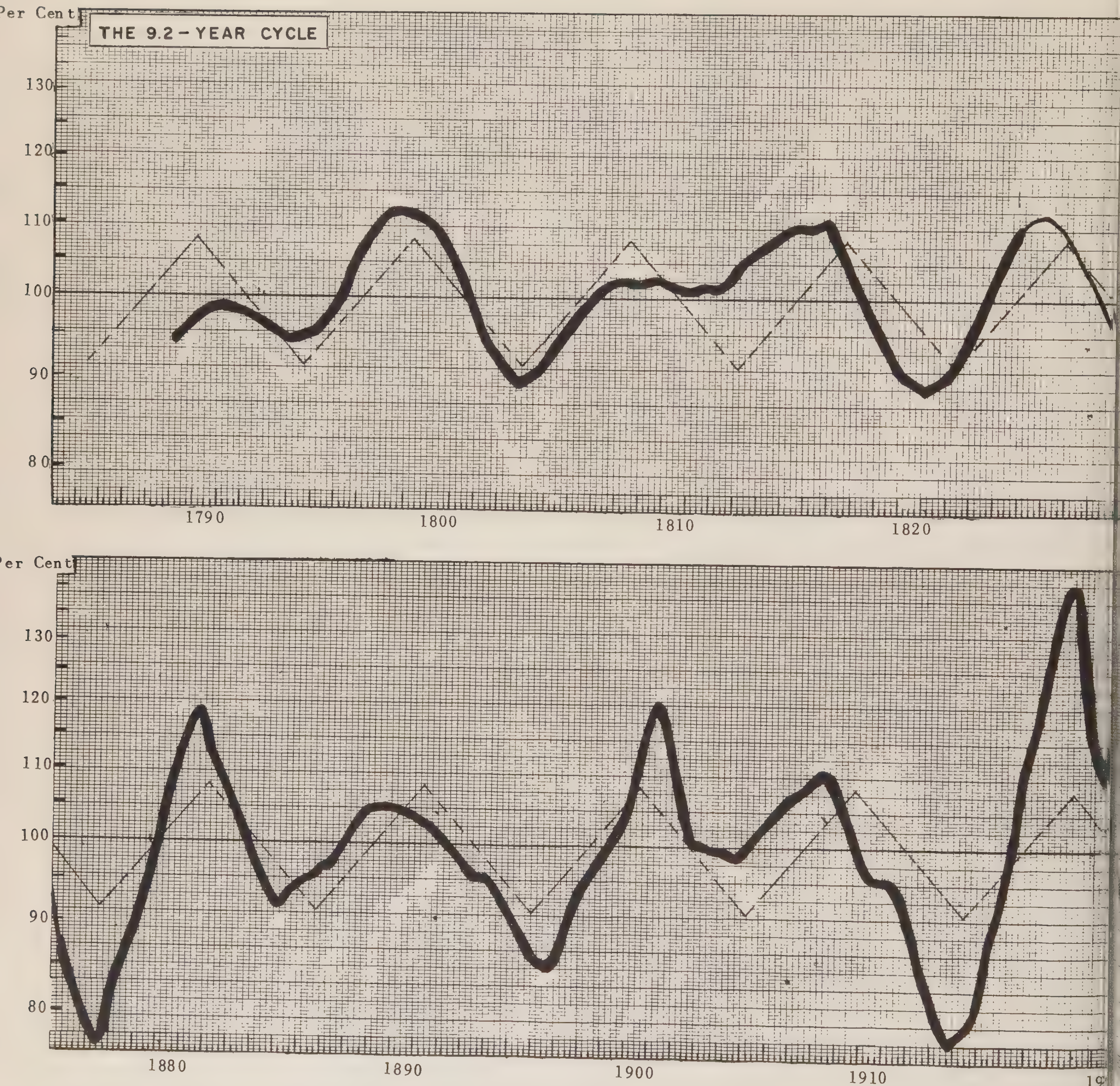
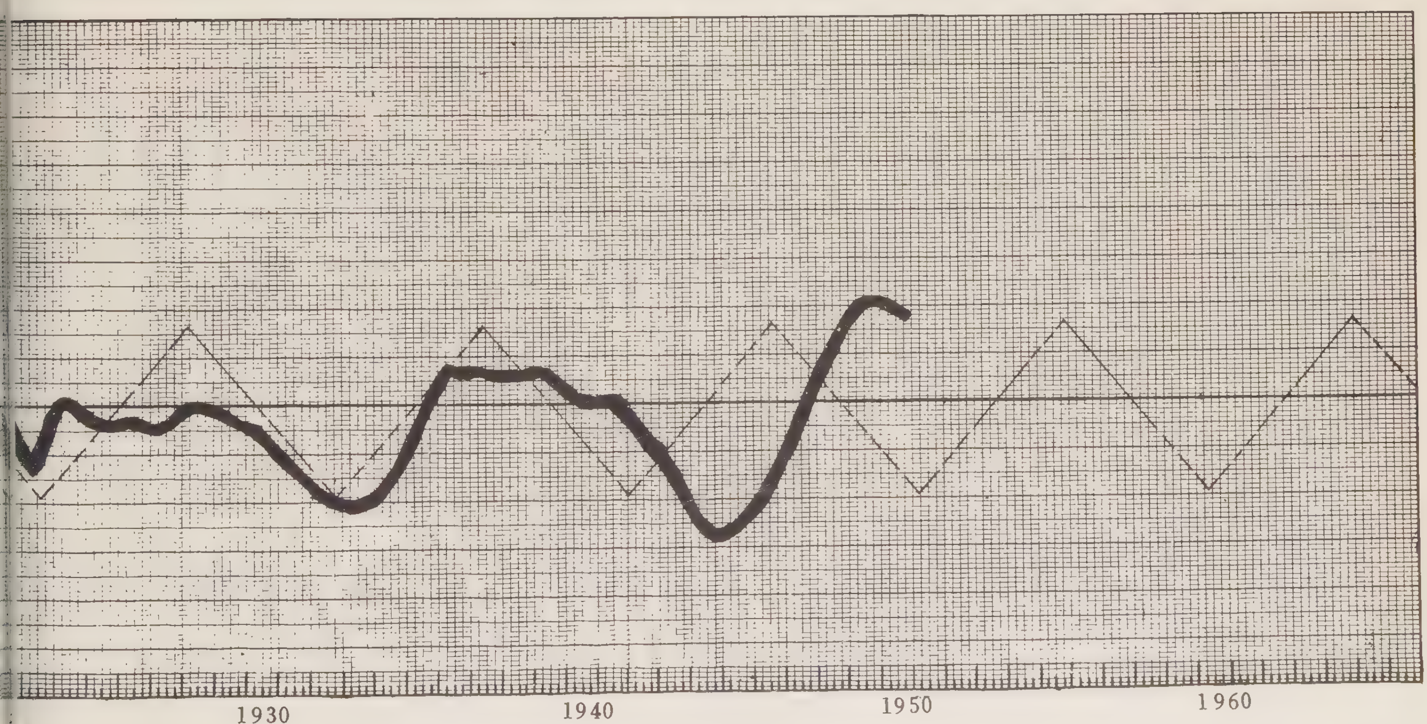


FIG. 28: PIG IRON PRICES, 1789—1950

The solid line shows the percentages by which smoothed pig iron prices have been above or below their long term trend. The broken line diagrams a perfectly regular 9.2-year cycle. Ratio Scale. The heavy line from the beginning to 1825 shows how the cycle appeared in after-discovered figures. The heavy line from 1875 shows how the cycle has unfolded since discovery. Source: *Cycles*, March, 1956, pp. 70—73.

9.2 — Year Cycle



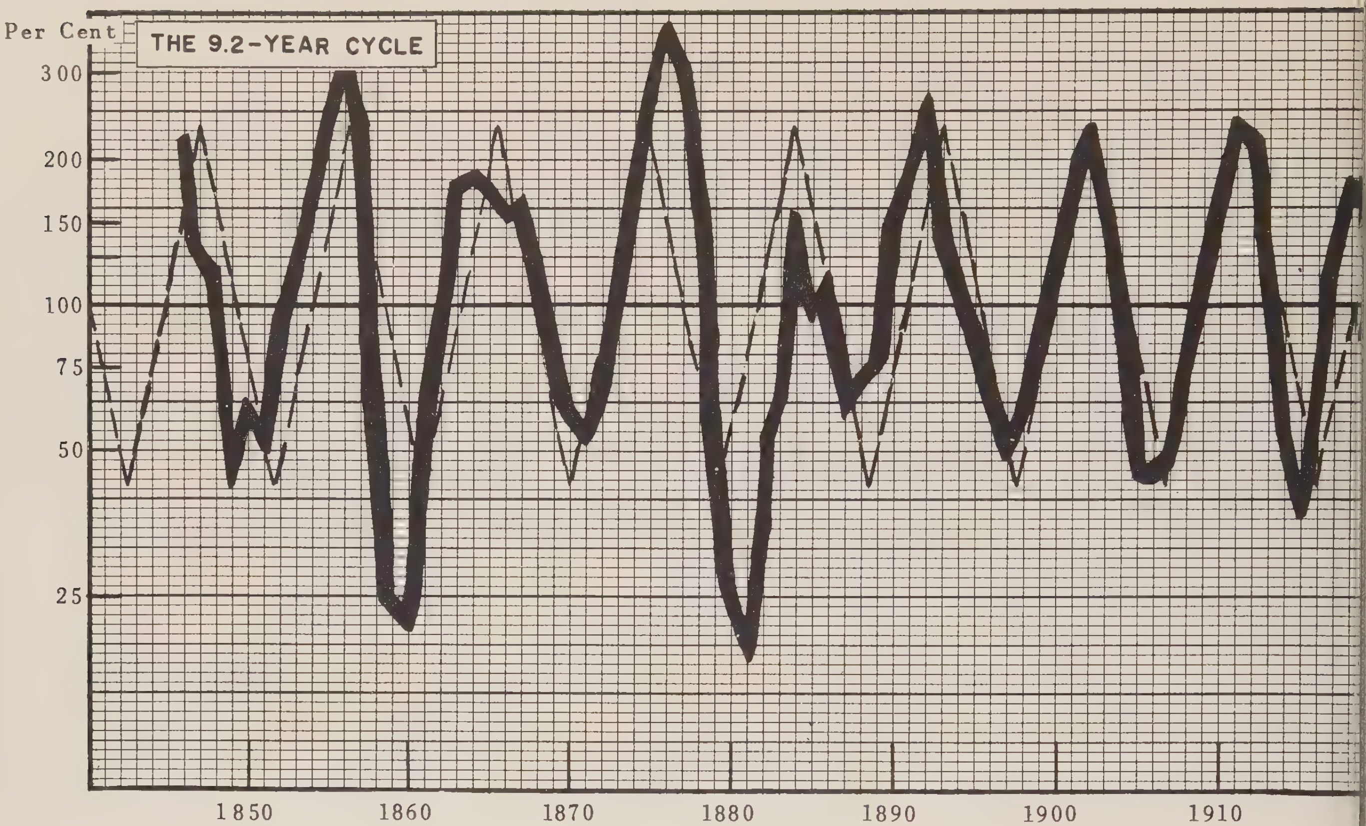


FIG. 29: GRASSHOPPER ABUNDANCE, 1846—1935

The heavy line shows the percentages by which a 3-year moving average trend of the data are above and below a 9-year moving average trend of the data. All the moving average trends are geometric moving average trends. The zigzag line diagrams a perfectly regular 9.2-year cycle. Ratio Scale. Source: *Cycles*, November, 1954, p. 318.

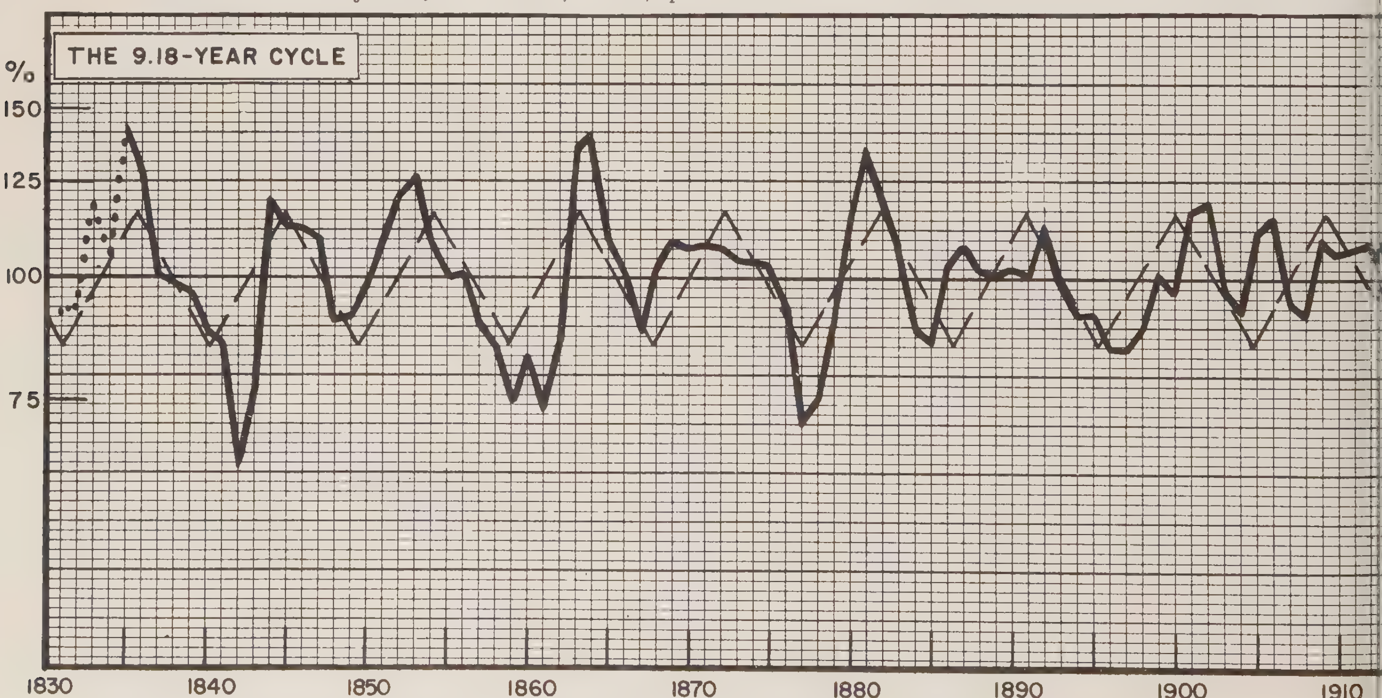
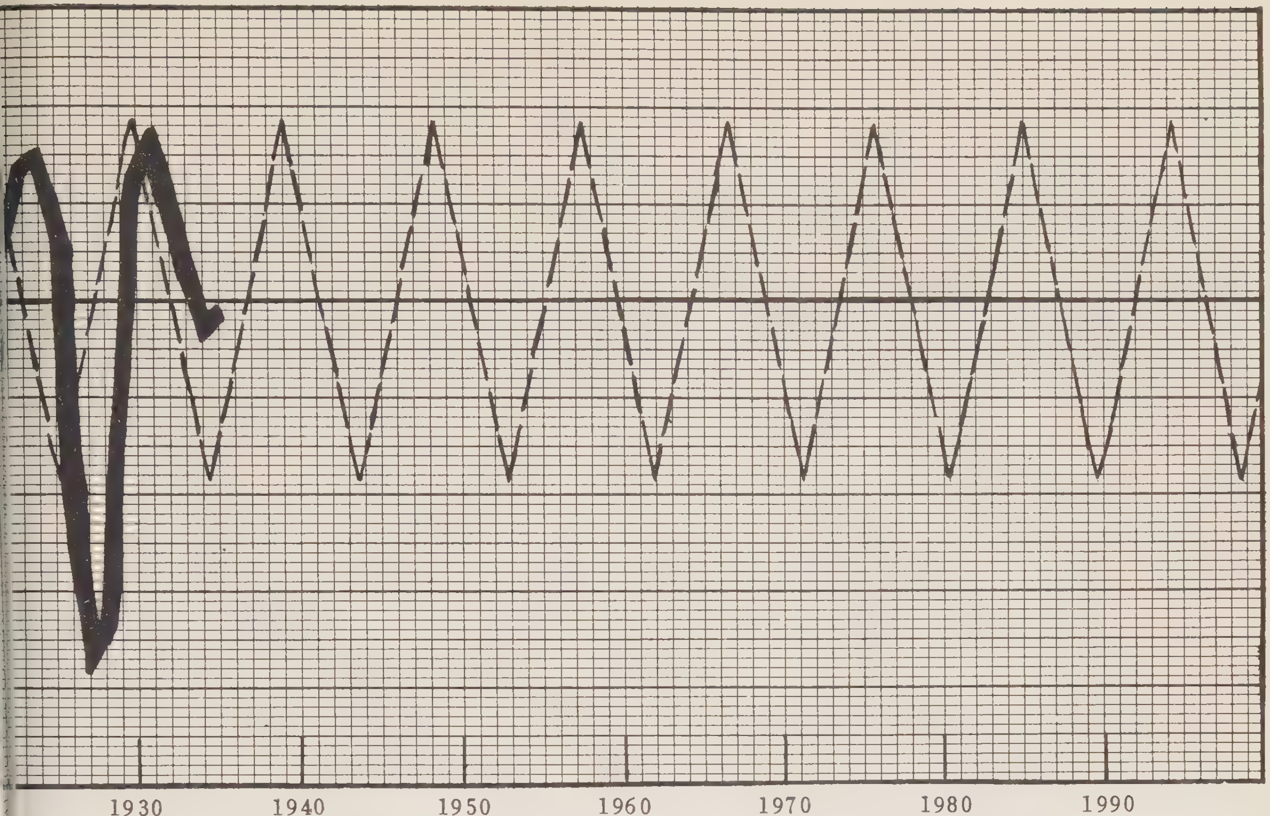


FIG. 30: INDEX OF RAILROAD STOCK PRICES, 1831—1955

Deviations of data from a 9-year trend. The zigzag line diagrams a perfectly regular 9.18-year cycle. Source: *Cycles*, November, 1956, pp. 290—291.


1930
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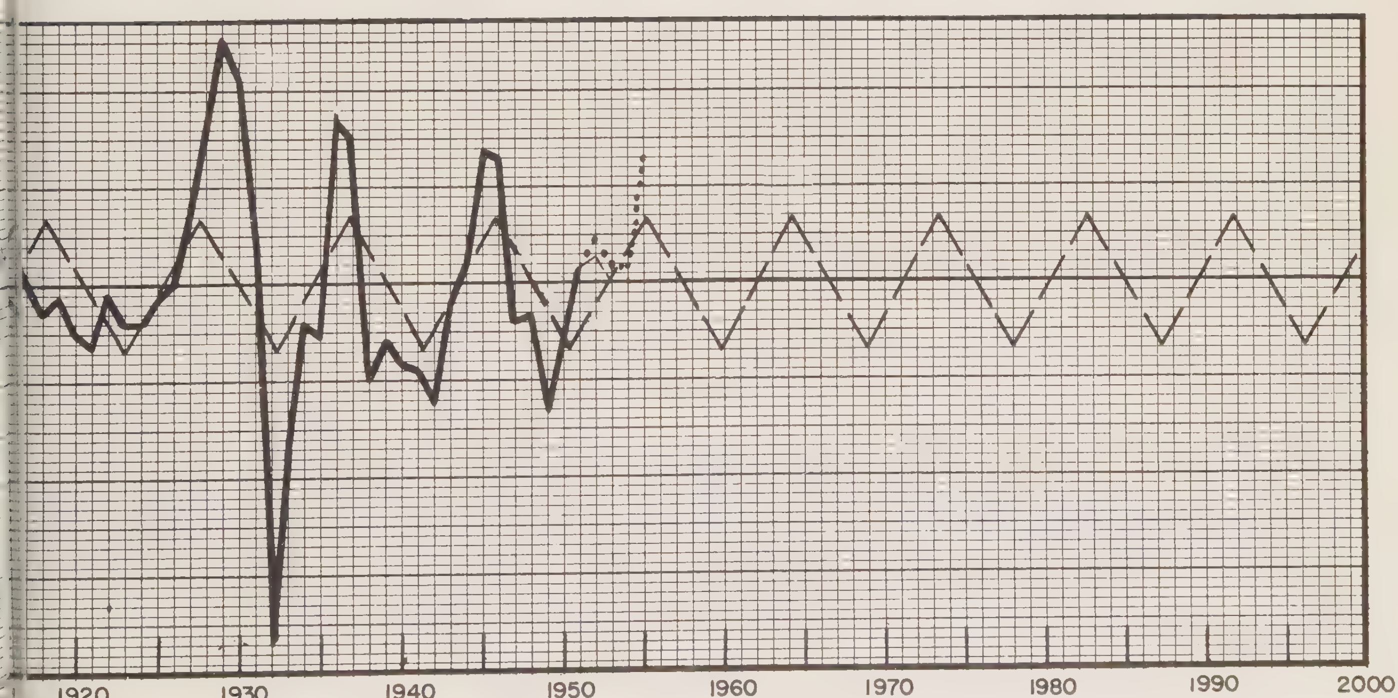
1960
1970
1980
1990


1920
1930
1940
1950
1960
1970
1980
1990
2000

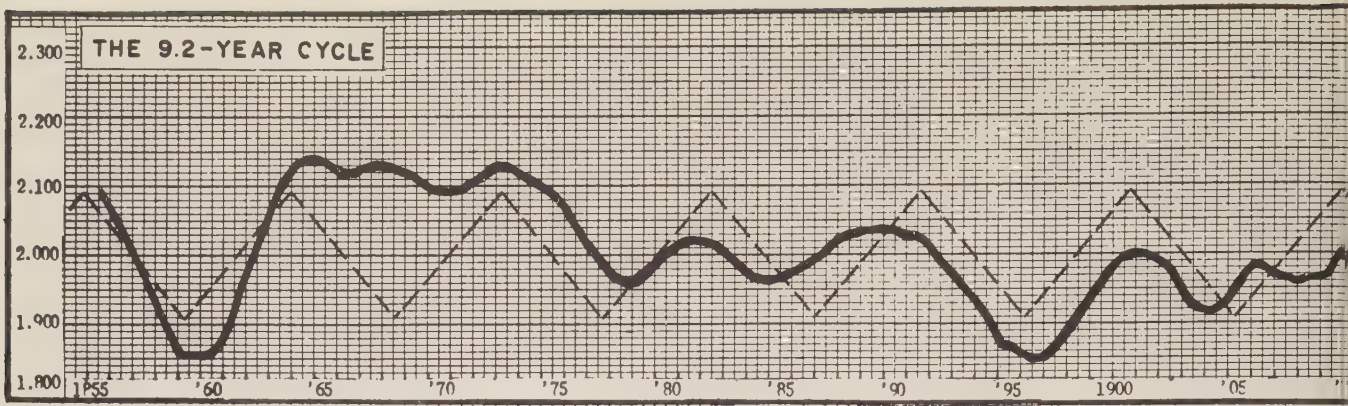


FIG. 31: COMMON STOCK PRICES, 1855—1954

The solid line shows the percentages by which common stock prices, smoothed by a 13-quarter moving average, have been above or below a straight line trend. The zigzag line diagrams a perfectly regular 9.2-year cycle. The heavy line since 1940 shows how this cycle has come out since discovery. Ratio Scale. Source: *Cycles,* March, 1956, pp. 74—75.

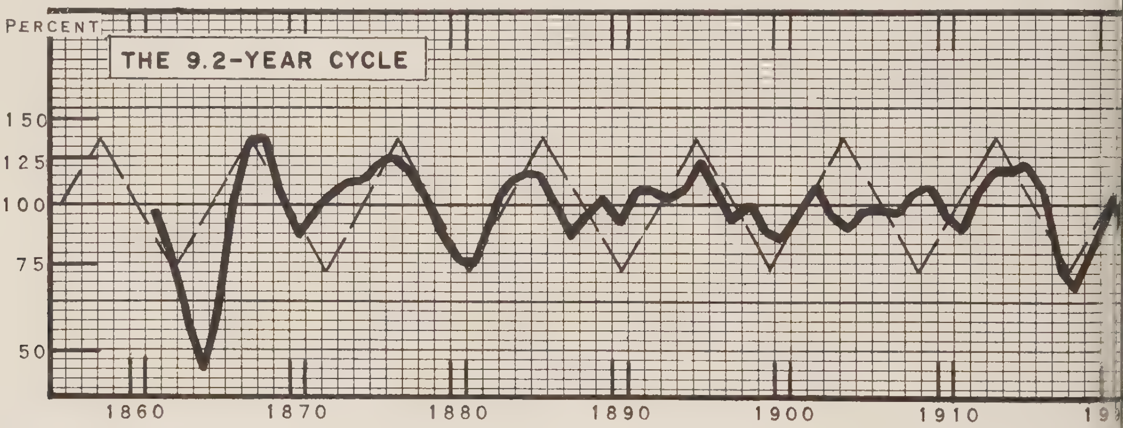


FIG. 32: BUSINESS FAILURES, 1861—1952

The solid line shows the percentages that the values of the 5-year moving average of the data are of the values of the 9-year moving average of the data. Heavy portion, 1948—1952, shows how the cycle has unfolded since discovery. The zigzag line diagrams a perfectly regular 9.2-year cycle. Source: *Cycles,* May, 1957, pp. 132—133.

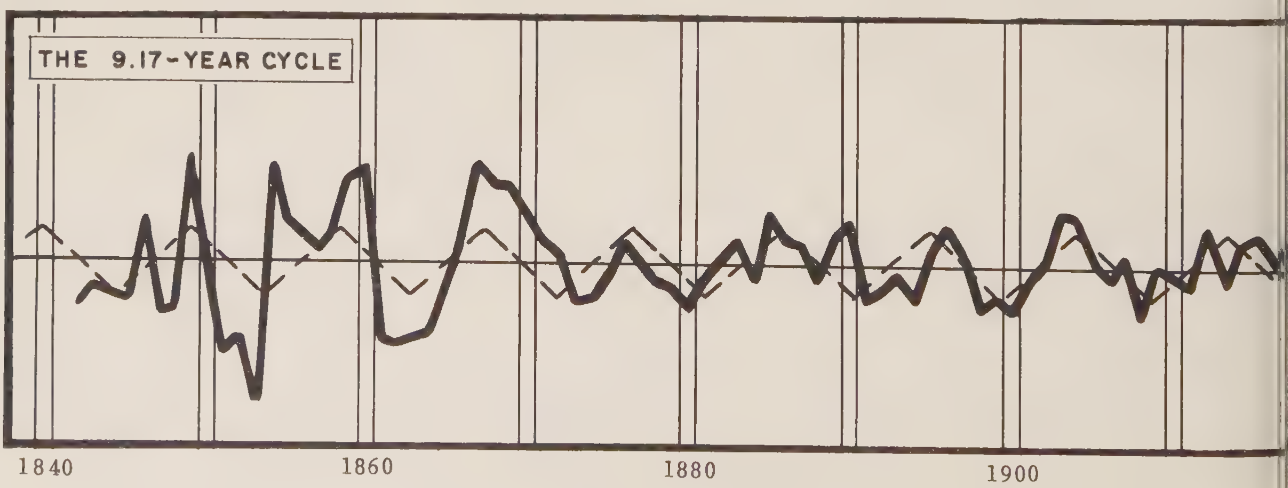
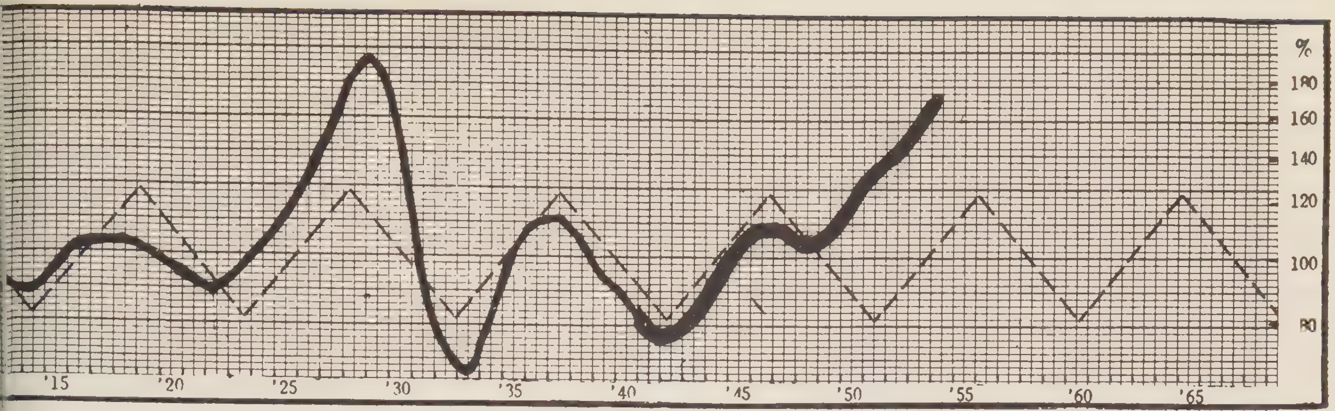
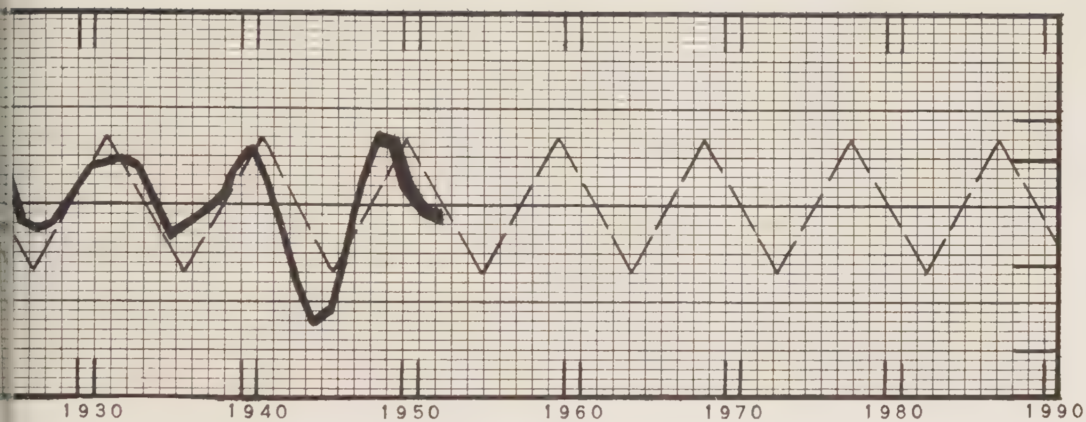
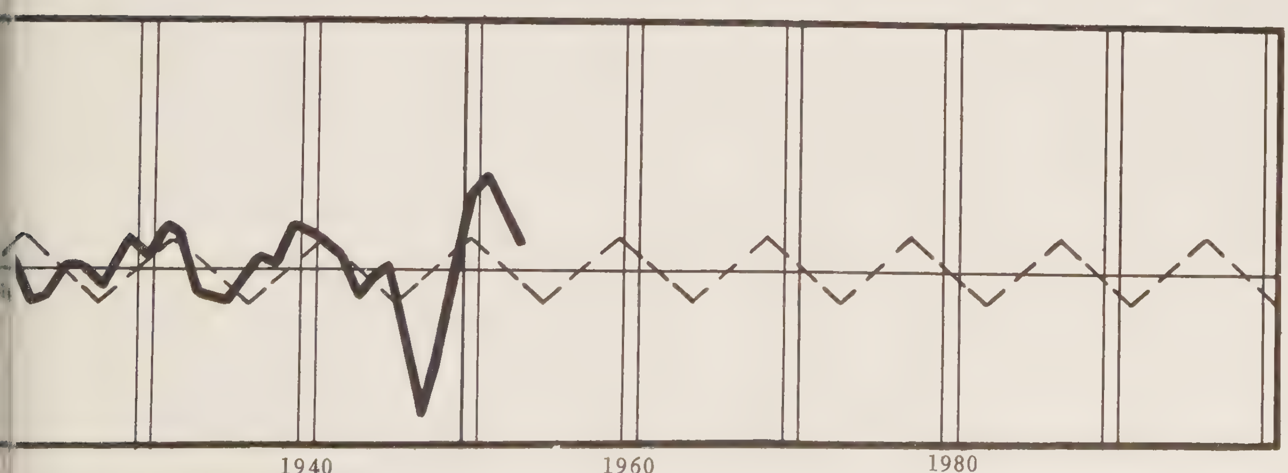


FIG. 33: PATENTS ISSUED, 1842—1953

Deviations from trend after removal of the effect of a 8.3-year cycle also present in these figures. The zigzag line diagrams a perfectly regular 9.17-year cycle. Source: *Cycles,* December, 1958, pp. 318—319.


%
180
160
140
120
100
80
'15
'20
'25
'30
'35
'40
'45
'50
'55
'60
'65


1930
1940
1950
1960
1970
1980
1990


1940
1960
1980

Illustrations of the

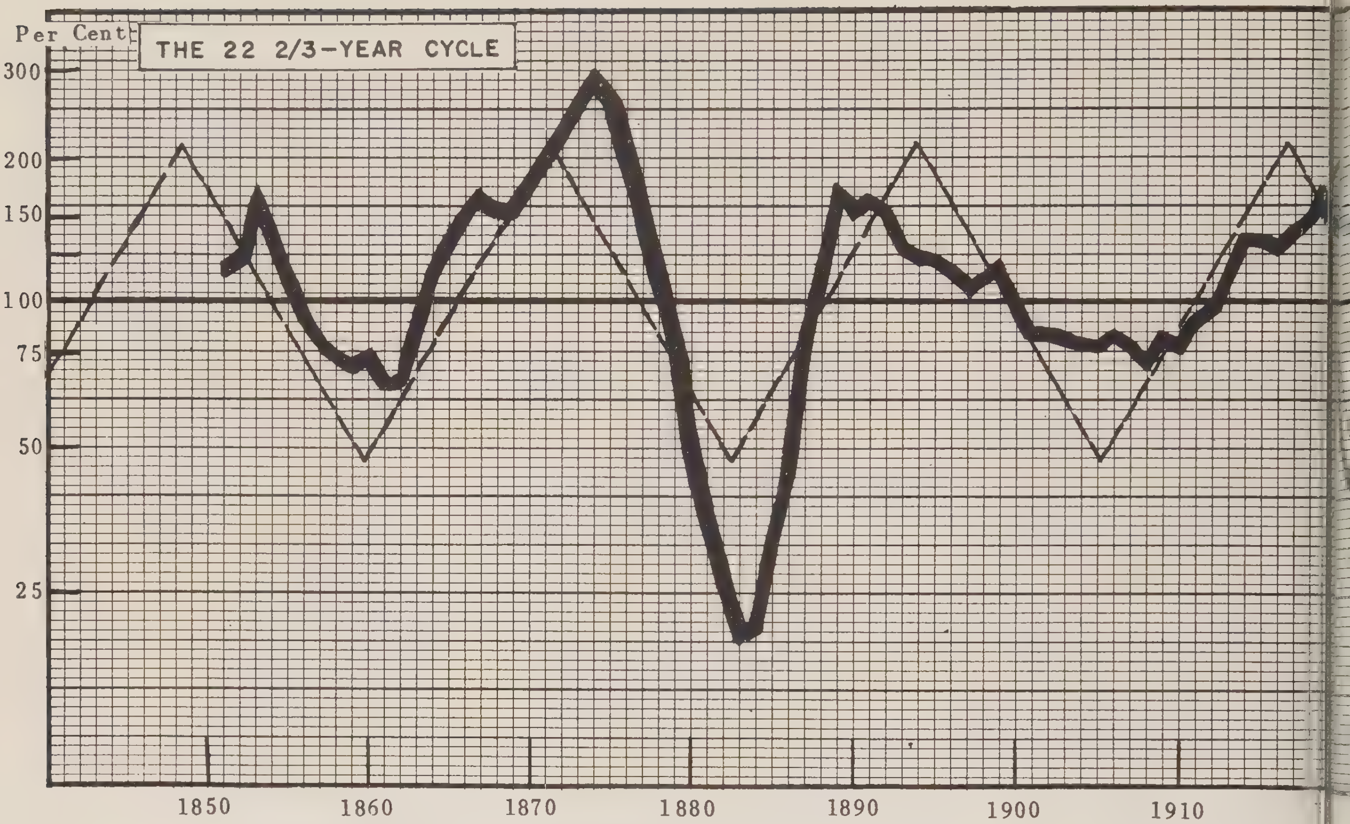


FIG. 34: GRASSHOPPER ABUNDANCE, 1851—1930

The heavy line shows the percentages by which a 9-year moving average trend of the data are above and below a 21-year moving average trend of the data. All the moving average trends are geometric moving average trends. The zigzag line diagrams a perfectly regular 22 2/3-year cycle. Ratio Scale. Source: *Cycles*, November, 1954, p. 319.

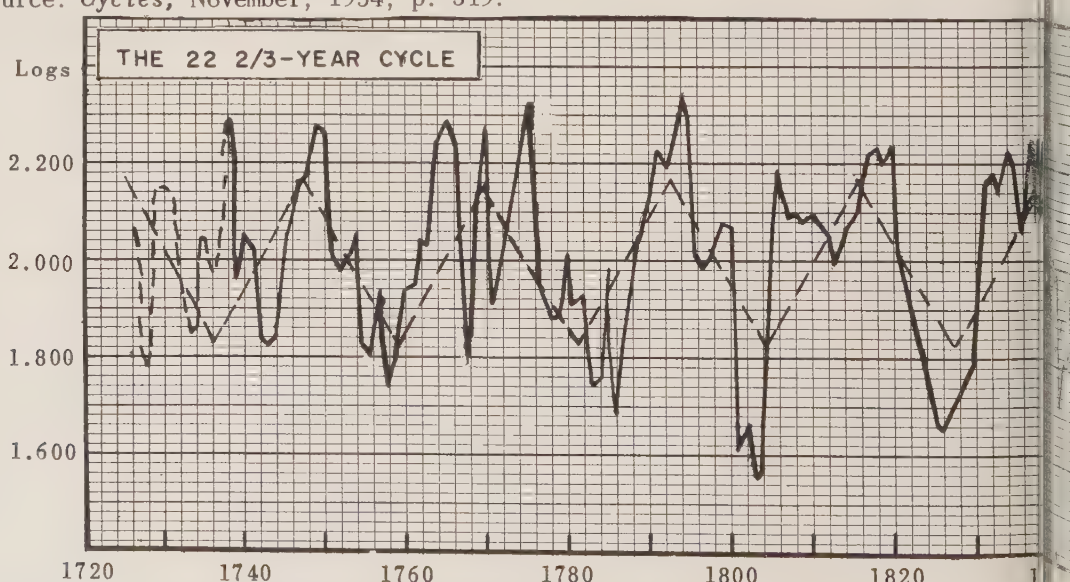
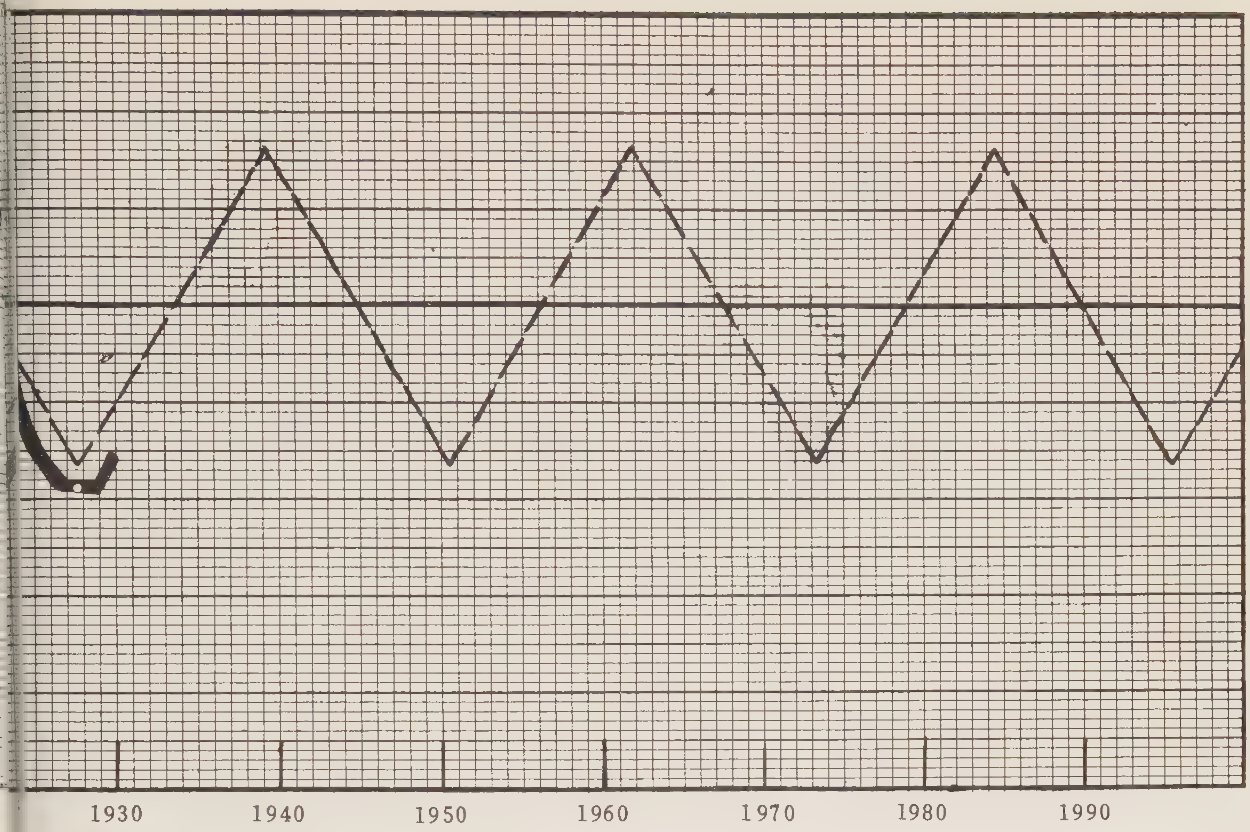
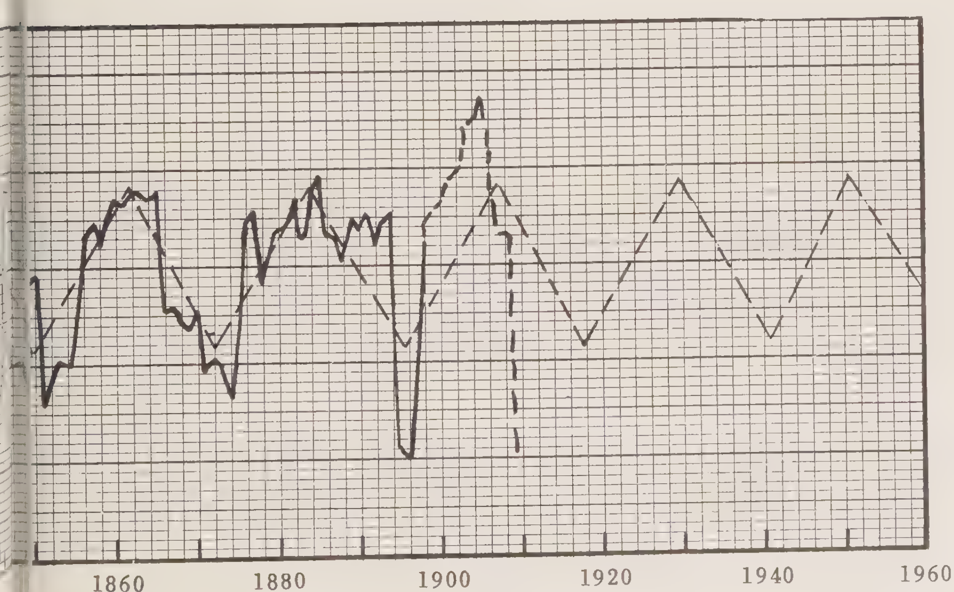


FIG. 35: THE ABUNDANCE OF THE EUROPEAN PARTRIDGE, 1727—1909

Deviations from the 23-year moving average trend. The zigzag line diagrams a perfectly regular 22 2/3-year cycle. Source: *Cycles*, April, 1953, pp. 110—111.

22 2/3 — Year Cycle





Illustrations of Cycles That Have
and Cycles with

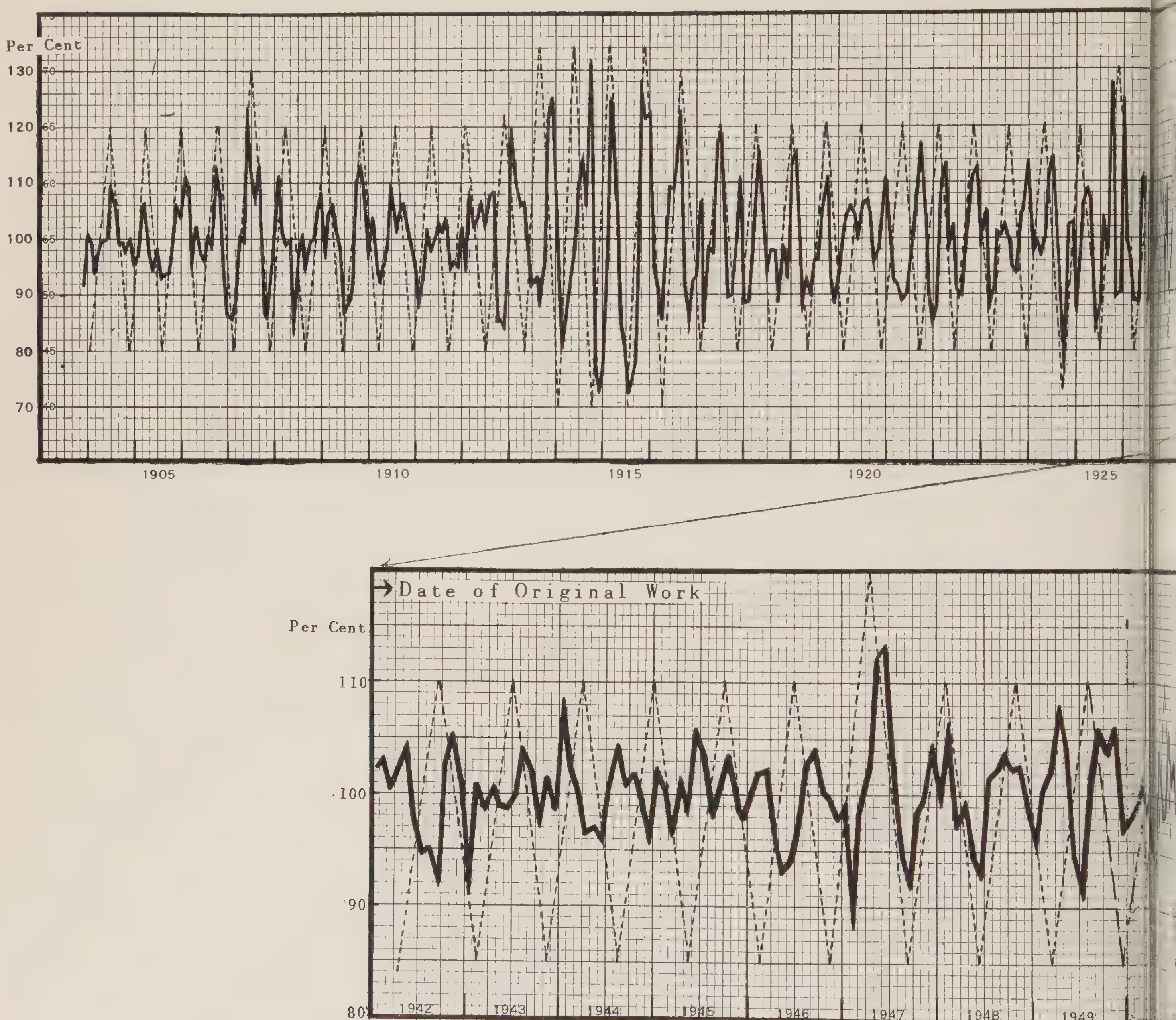
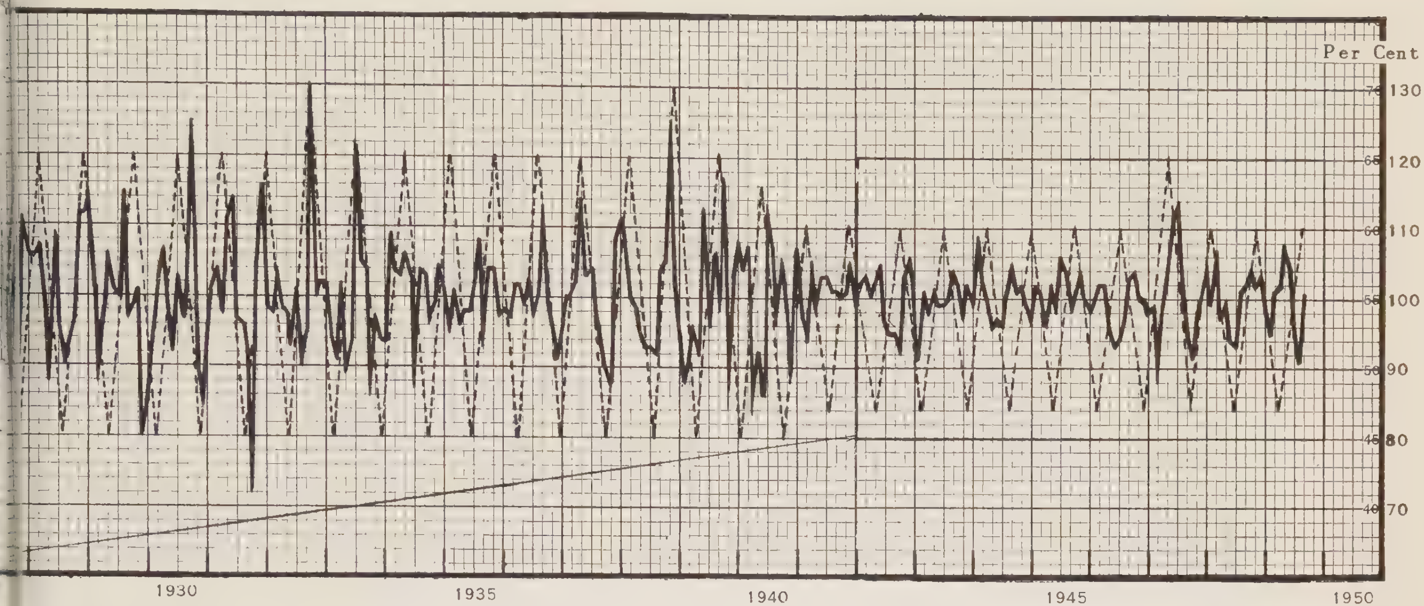
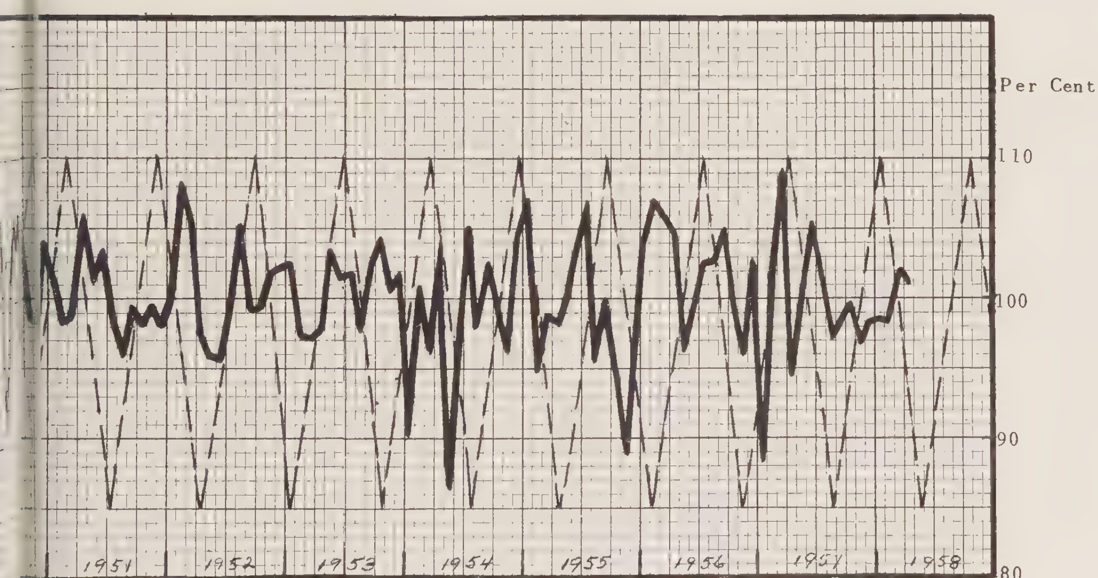


FIG. 36: CANADIAN PACIFIC RAILWAY, 1903—1958

Deviations of revenue ton miles, C.P.R., adjusted for seasonal, from their 9-month moving average, together with a perfectly regular 9.18-month cycle of varying amplitude. The section from 1942—1958 has been enlarged to show behavior since the cycle was discovered. Source: *Journal of Cycle Research,* October, 1958, pp. 112—113.

ersisted over Long Periods of Time
any Repetitions





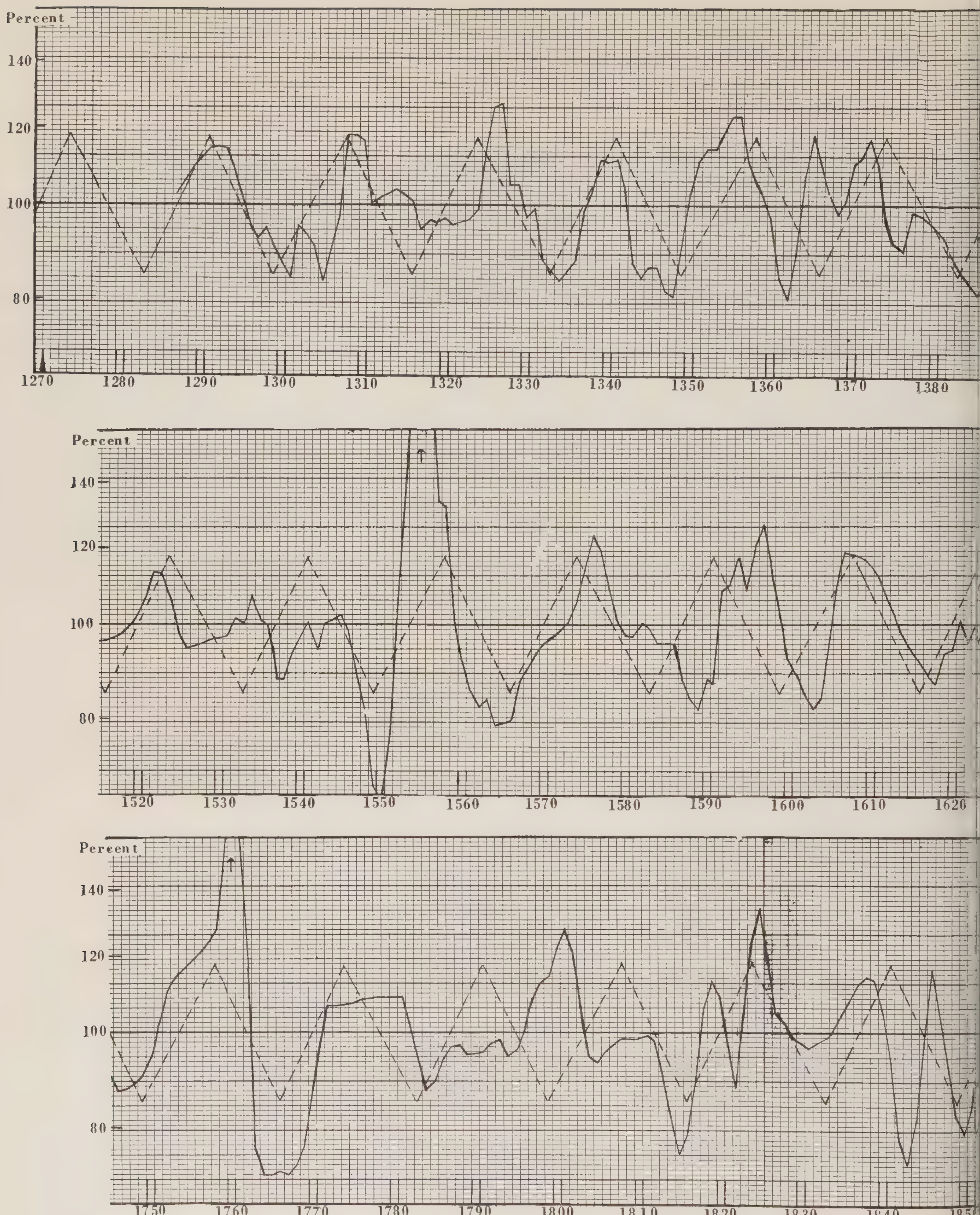
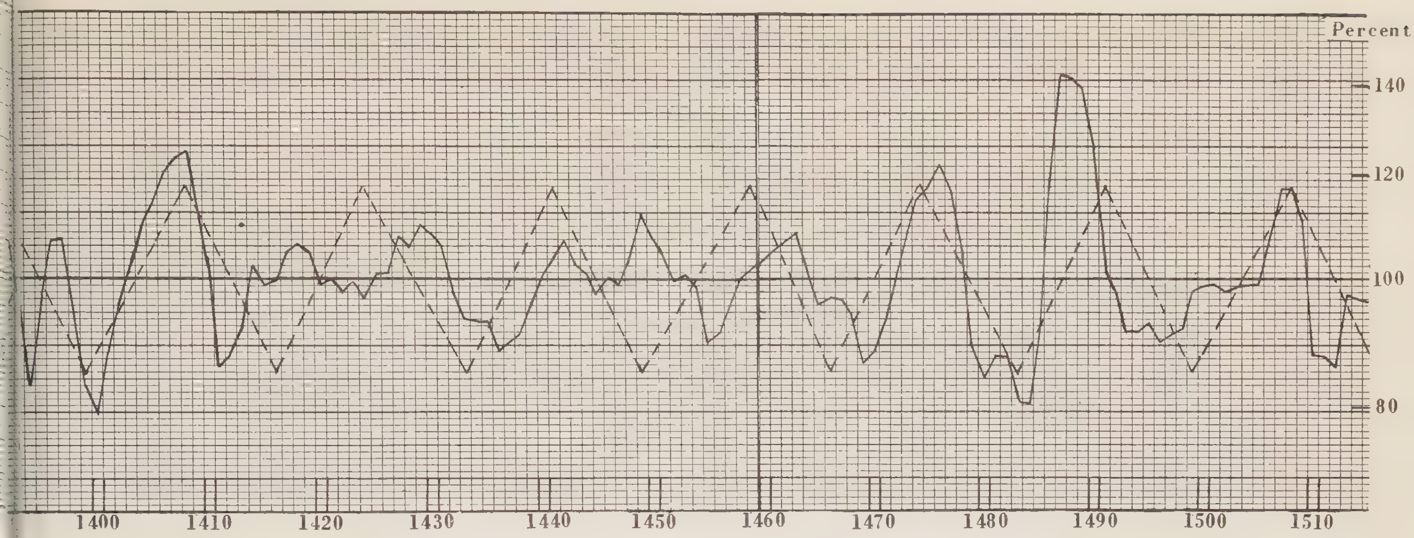


FIG. 37: BRITISH WROUGHT IRON PRICES, 1287—1908

Percentages by which actual prices (and interpolated values), smoothed by a 3-year moving average, were above or below trend. The zigzag line diagrams a perfectly regular 16 2/3-year cycle. Ratio Scale. Source: *Cycles*, May, 1955, pp. 142—147.


Percent
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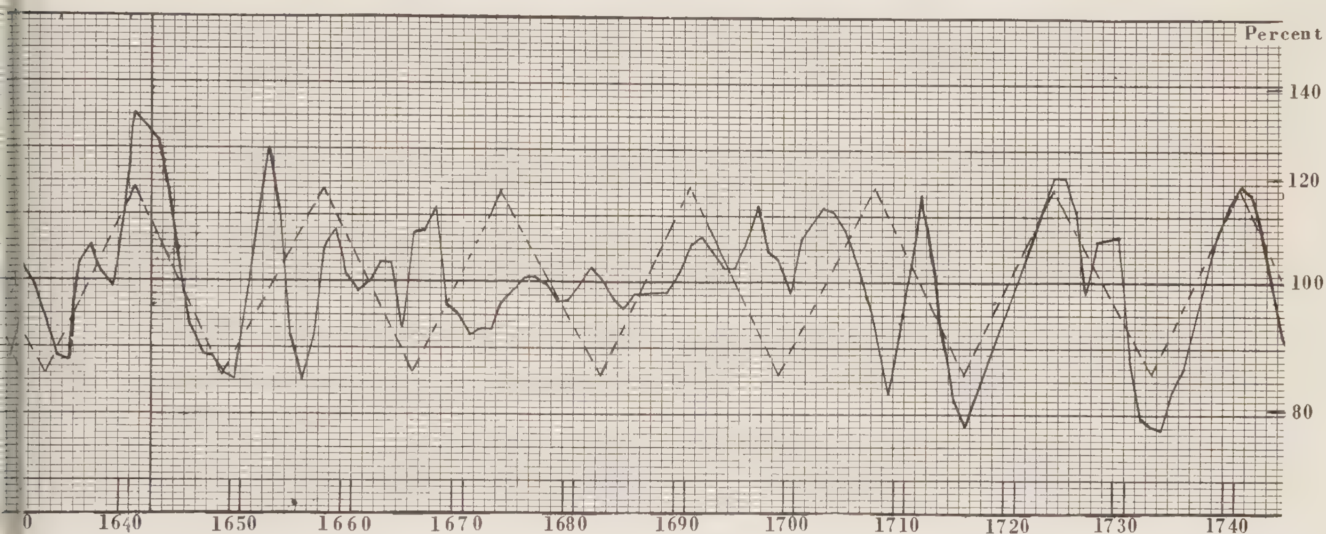
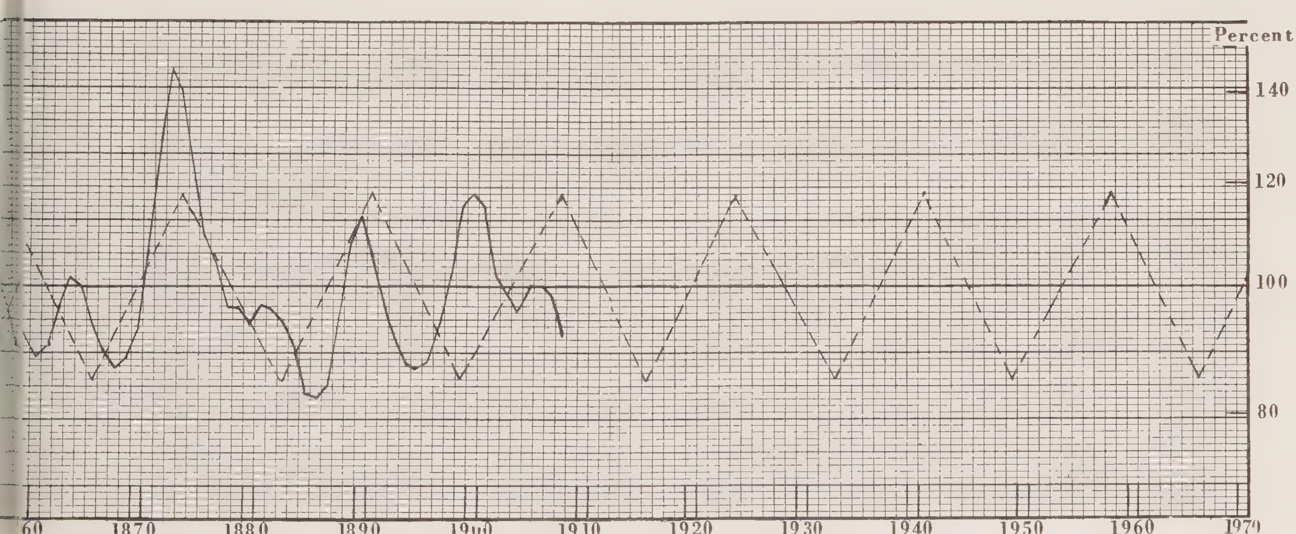
120
100
80
1400
1410
1420
1430
1440
1450
1460
1470
1480
1490
1500
1510


Percent
140
120
100
80
1640
1650
1660
1670
1680
1690
1700
1710
1720
1730
1740


Percent
140
120
100
80
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970

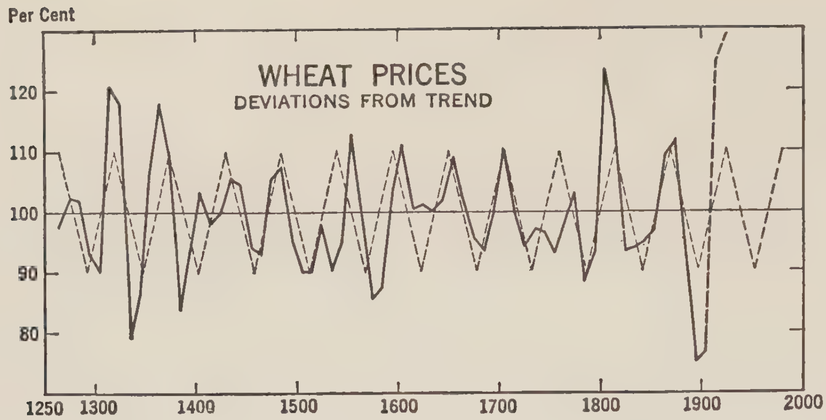
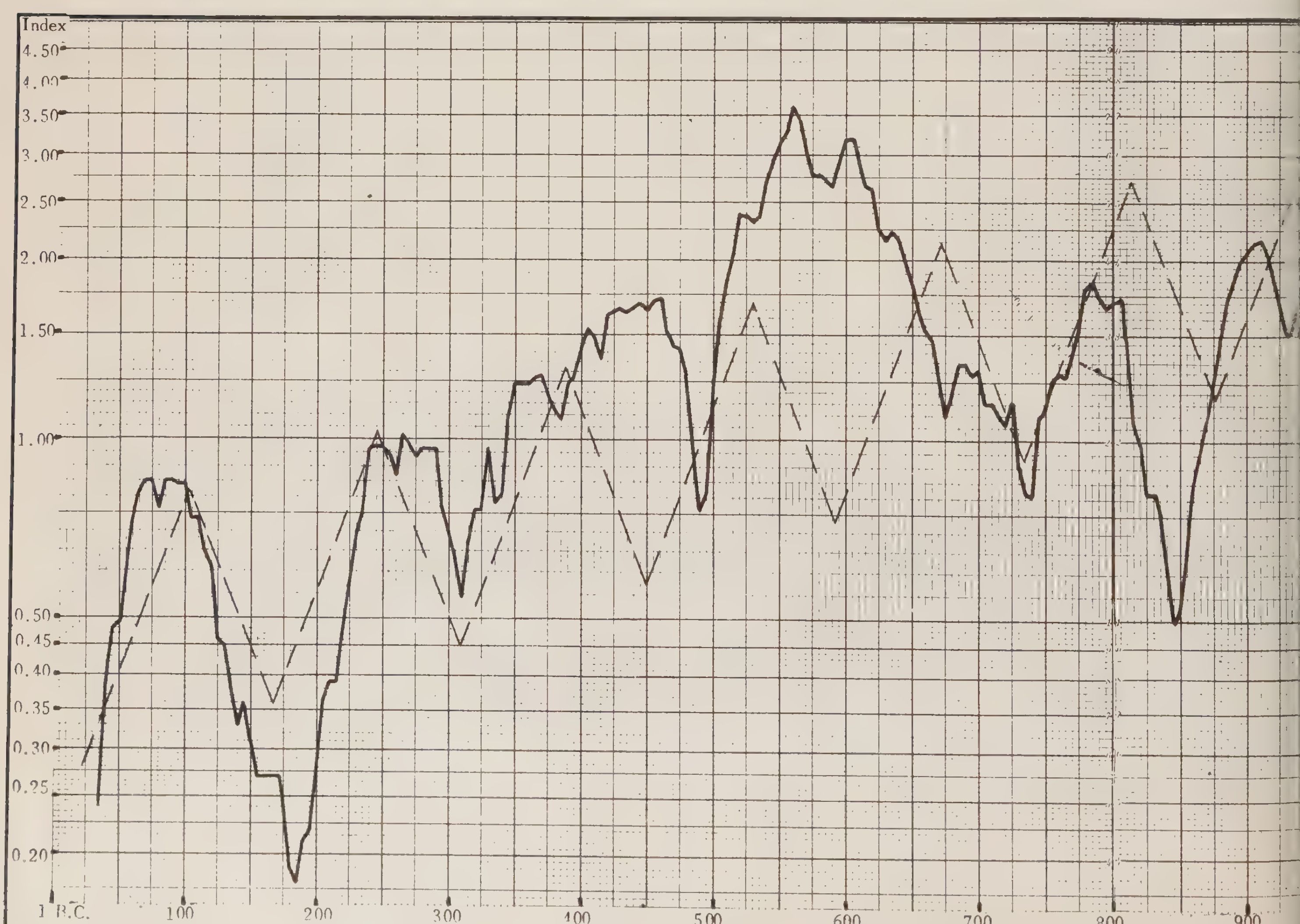


FIG. 38: WHEAT PRICES IN ENGLAND

Prices adjusted for trend and smoothed by two decade moving average. The zigzag line diagrams a perfectly regular 54-year cycle. Source: Dewey and Dakin, *Cycles, the Science of Prediction*. 1947. p. 72.



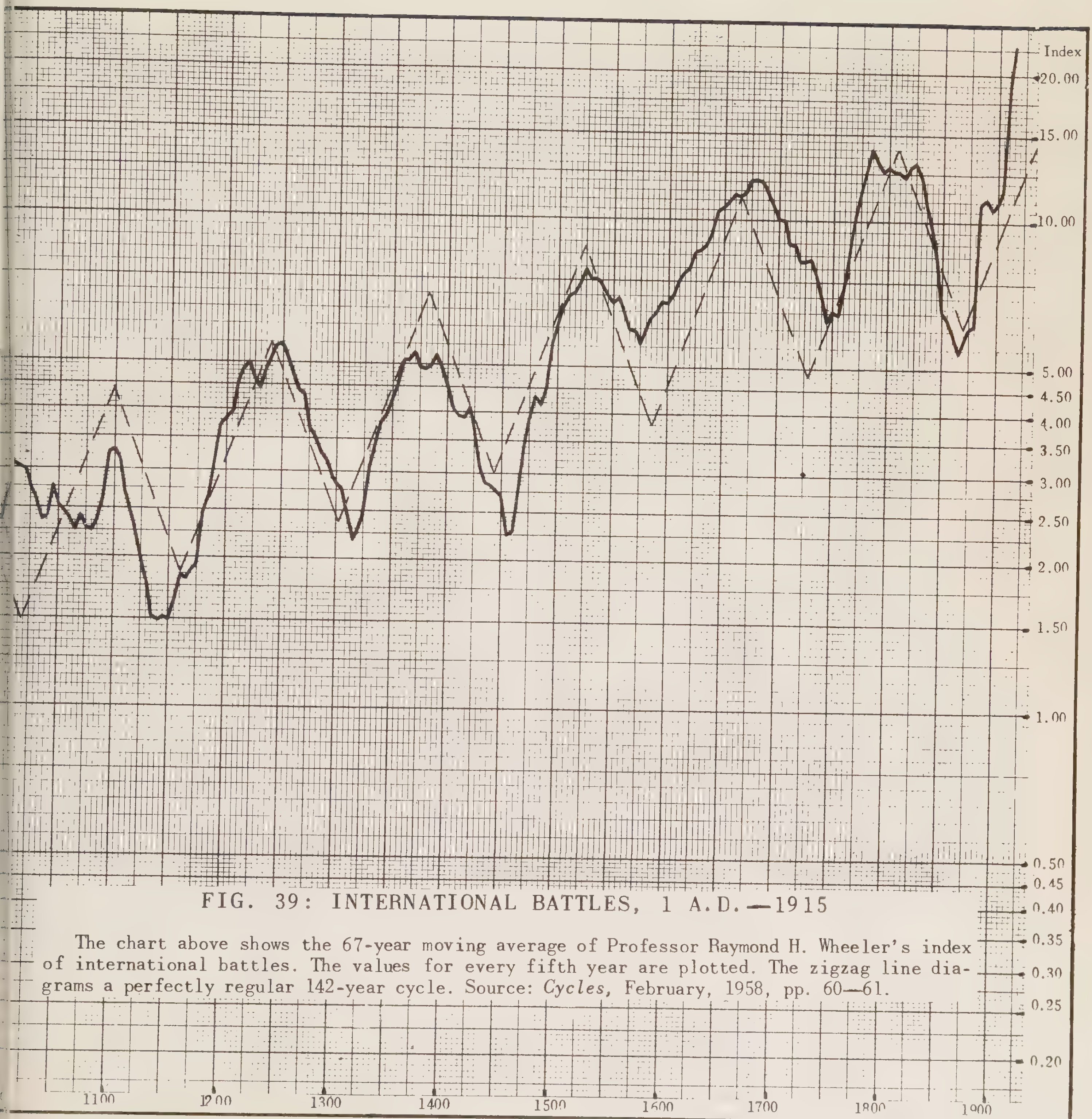


FIG. 39: INTERNATIONAL BATTLES, 1 A.D.—1915

The chart above shows the 67-year moving average of Professor Raymond H. Wheeler's index of international battles. The values for every fifth year are plotted. The zigzag line diagrams a perfectly regular 142-year cycle. Source: *Cycles*, February, 1958, pp. 60—61.

Illustrations of Cycles Which Have

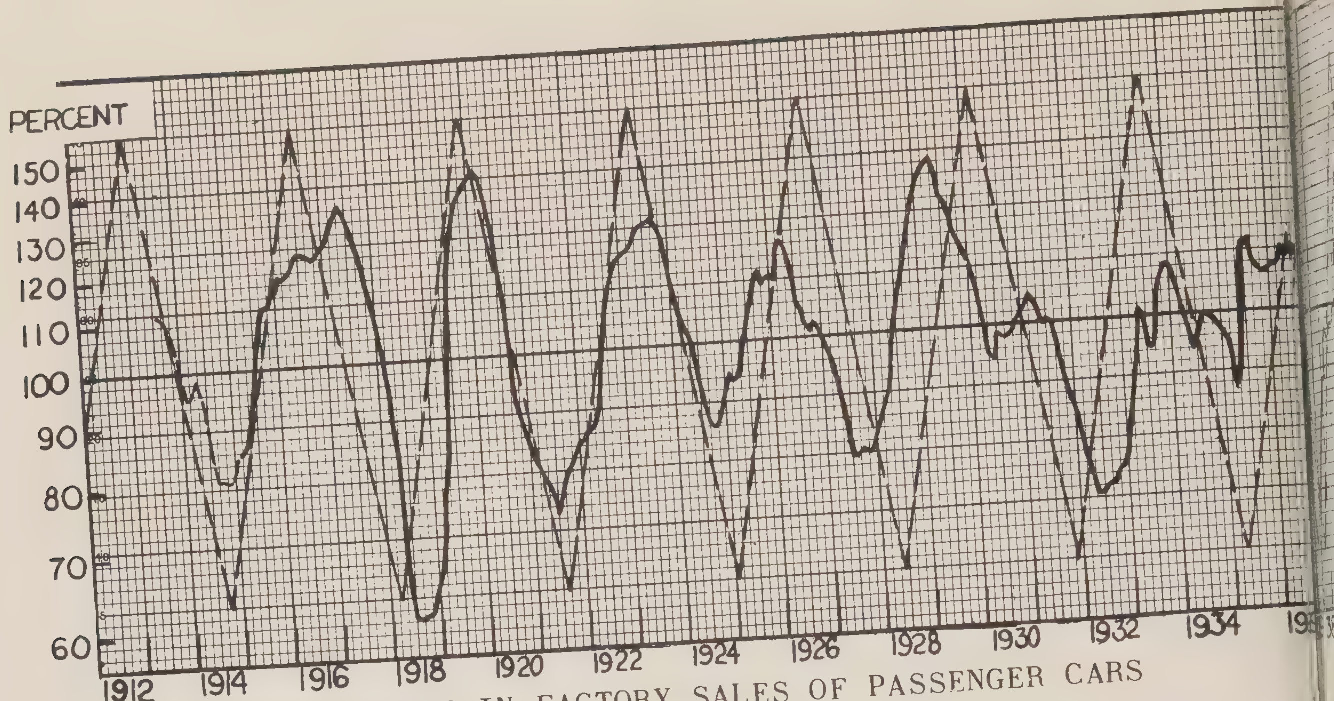


FIG. 40: THE 3.4-YEAR CYCLE IN FACTORY SALES OF PASSENGER CARS

The solid lines show percentages by which sales were above or below their 41-month moving average trend. The gap between 1941 into 1946 was caused by World War II. The solid line is broken at either end to indicate that trend for these months was estimated. The zigzag line diagrams a perfectly regular 3.4-year cycle. Ratio Scale. Note that end to end we have 11 1/2 cycles. Note that the pattern reappeared, in step, after the war distortion. Source: *Cycles*, October, 1954, pp. 286—287.

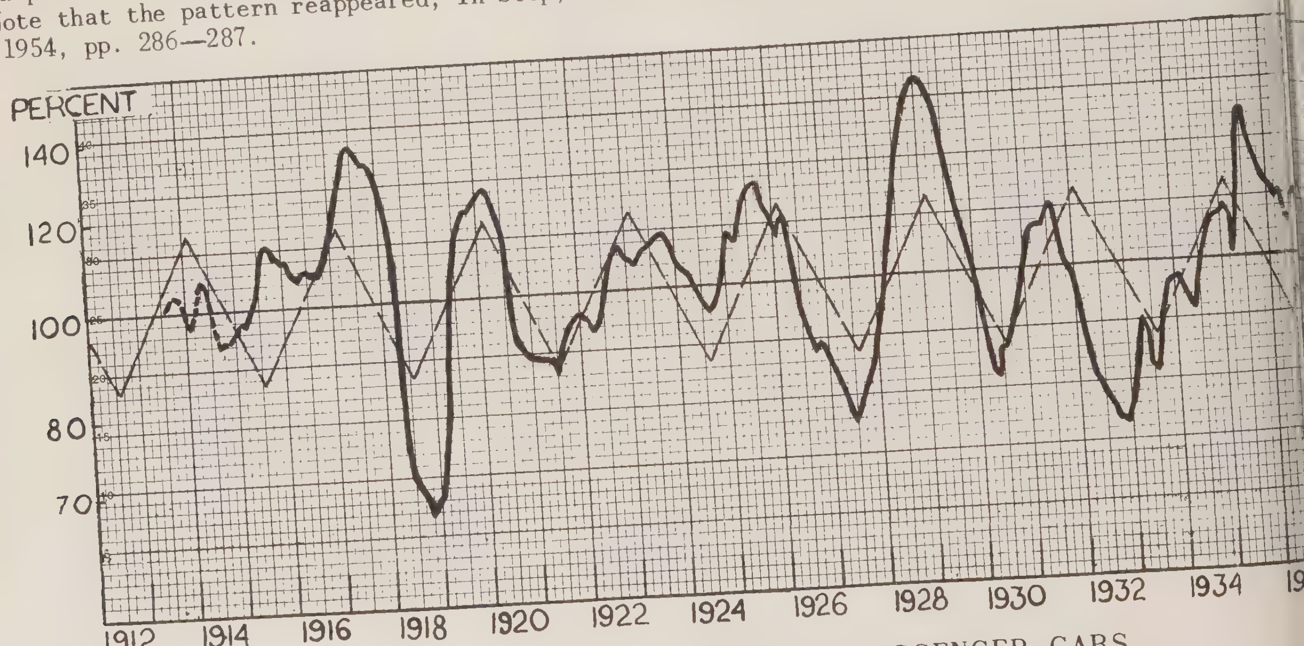
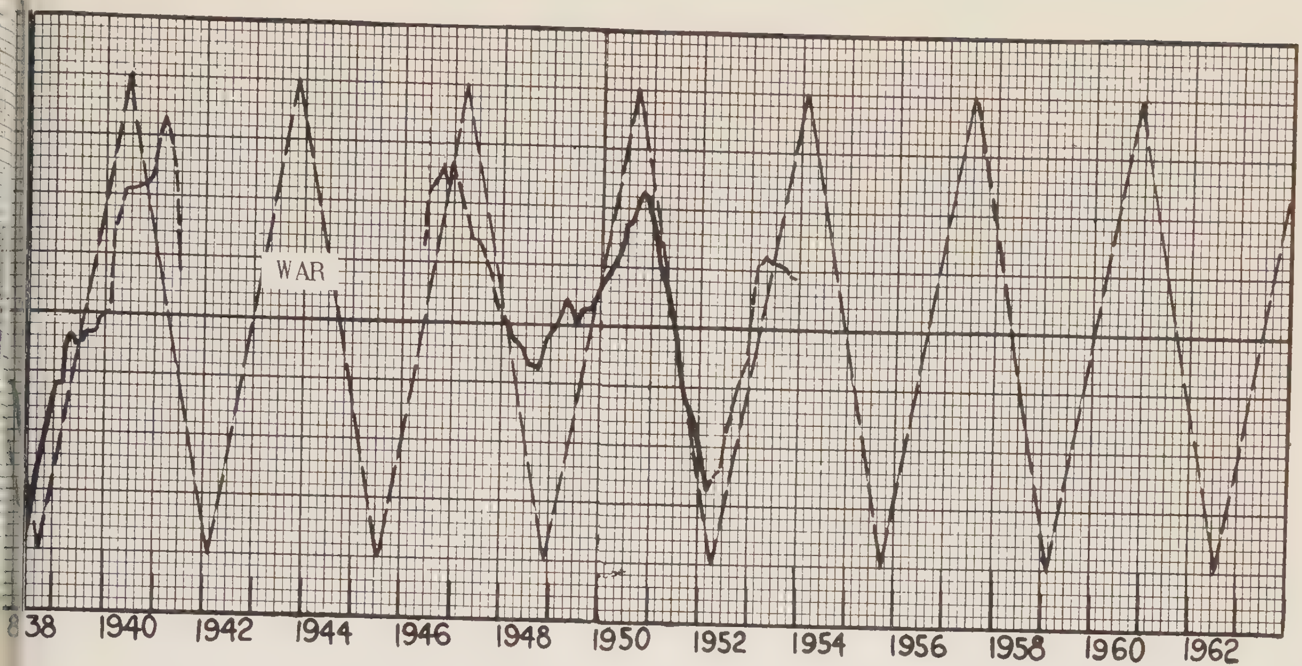
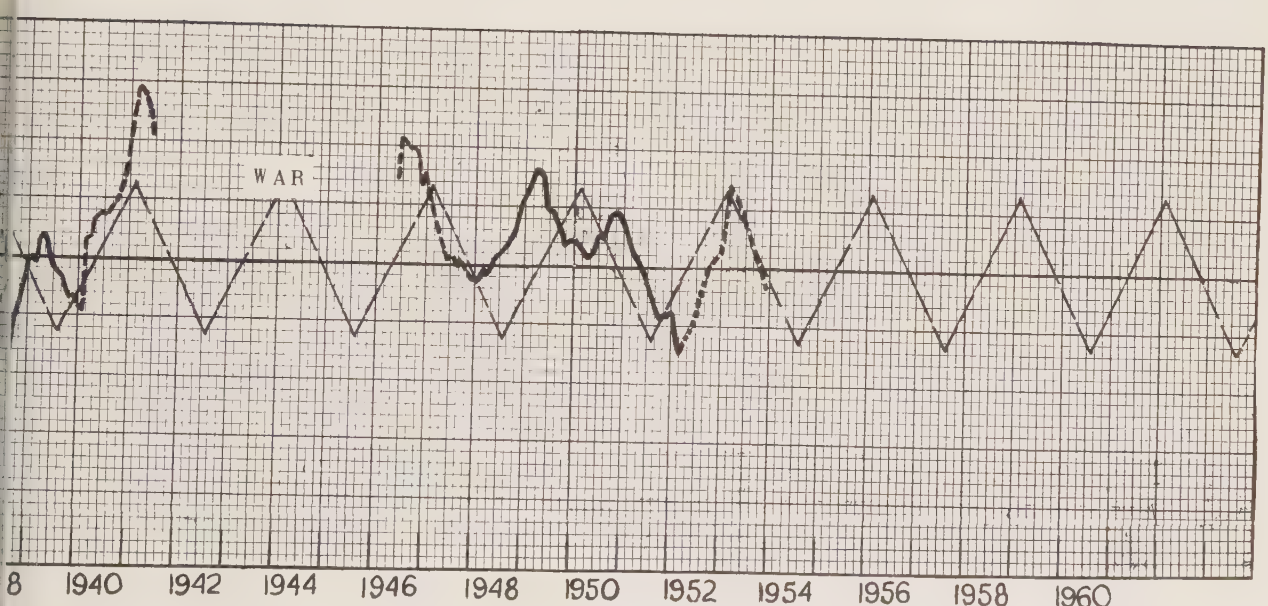


FIG. 41: THE 3-YEAR CYCLE IN FACTORY SALES OF PASSENGER CARS

Factory sales of passenger cars also evidence a 3-year cycle. This cycle can be seen more clearly if we adjust the figures for the effect of the 3.4-year cycle. This has been done in the chart above. The 3-year cycle, as well as the 3.4-year cycle, resumes after the war in phase (in step) with its pre-war timing. Ratio Scale. Source: *Cycles*, November, 1954, pp. 322—323.

verted Back to Pattern after War





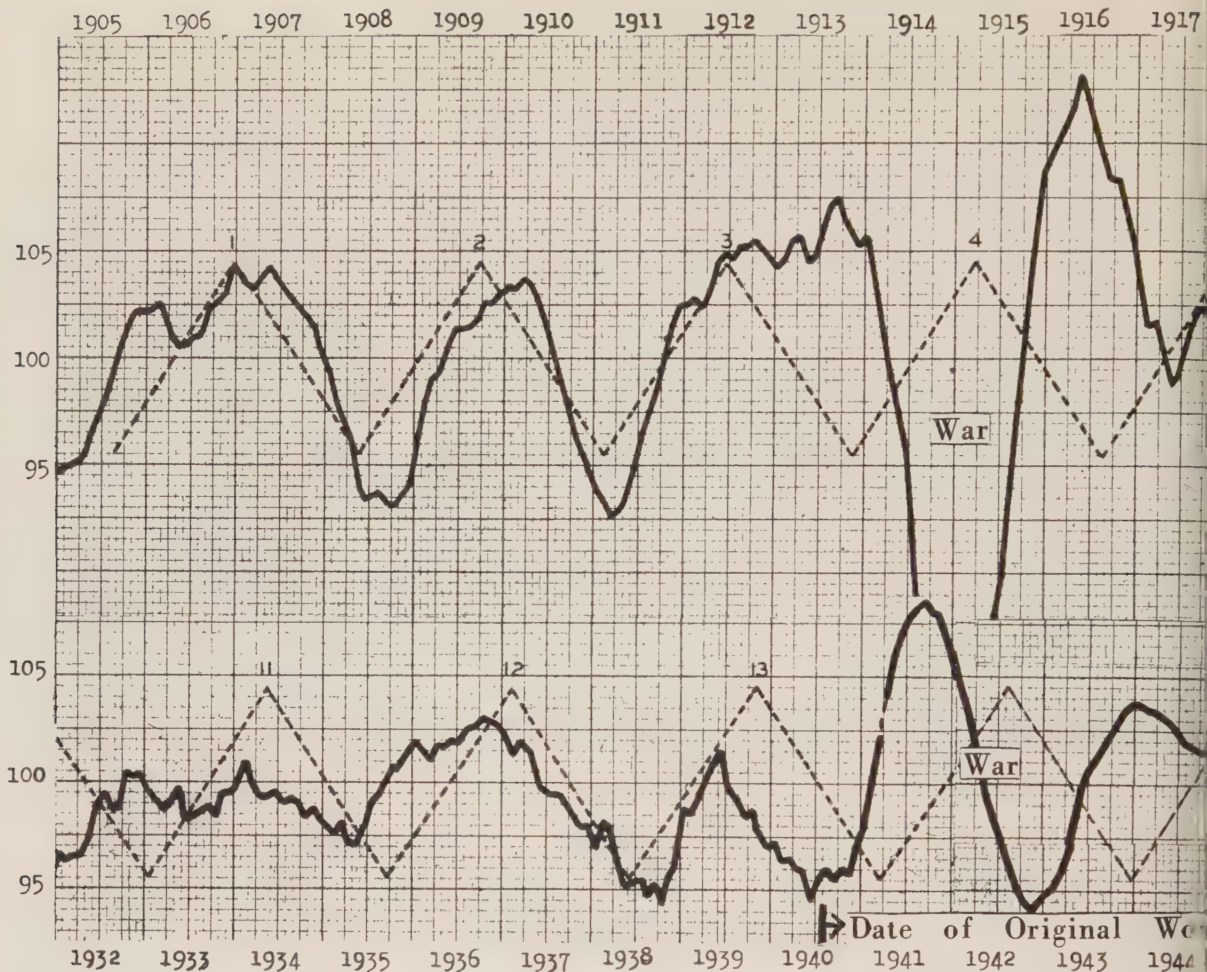


FIG. 42: CANADIAN PACIFIC RAILROAD REVENUE TON MILES, 1903—1957

Deviations of the 17- from the 33-month moving average (both seasonally adjusted) vs. the 32.86-month cycle. Source: *Journal of Cycle Research,* October, 1958, pp. 114—115.

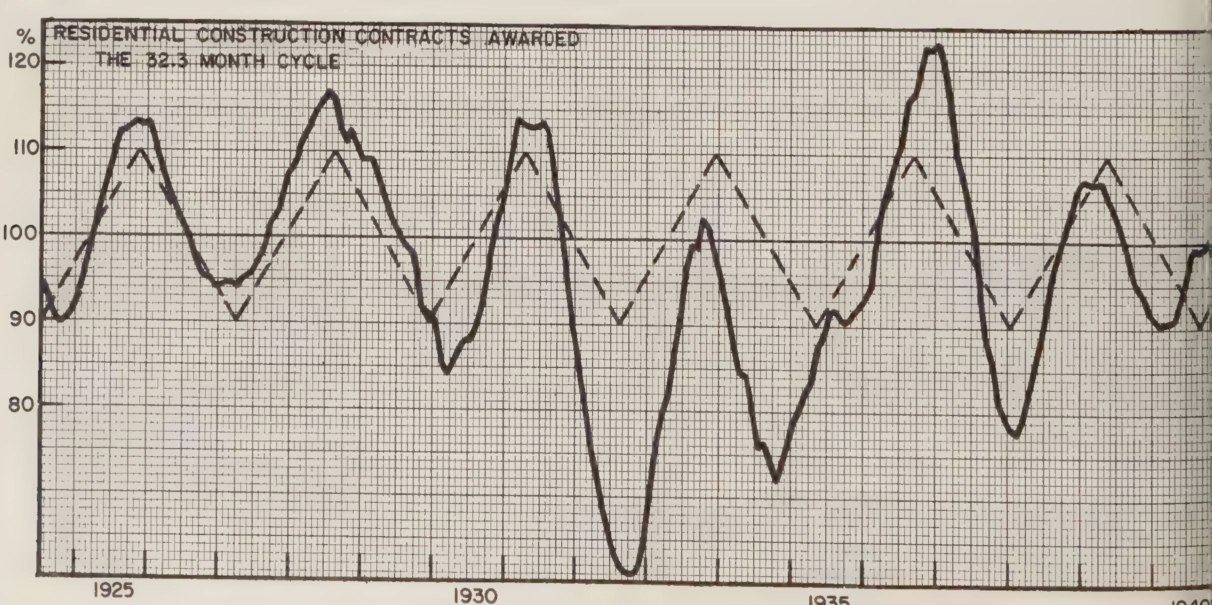
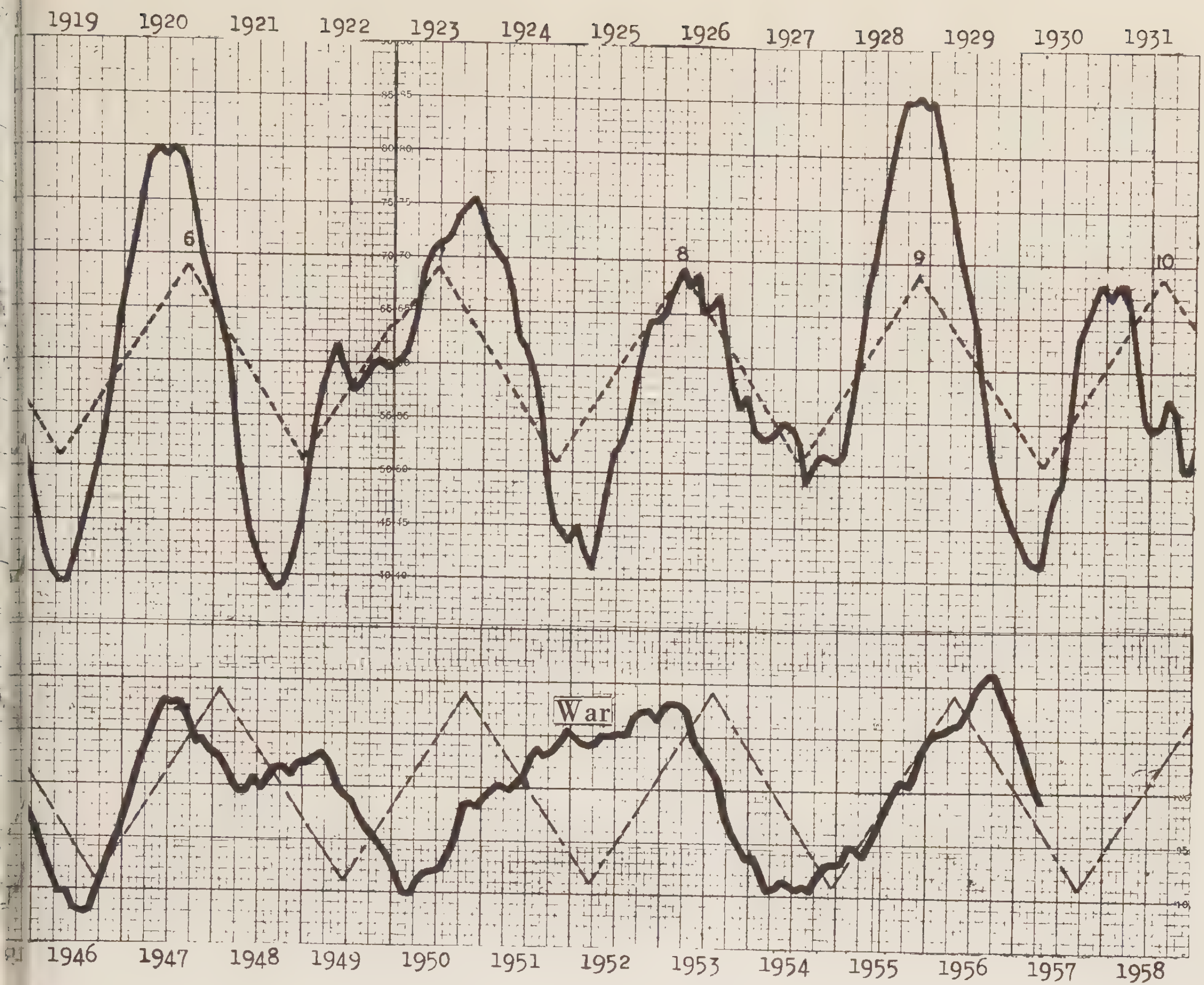


FIG. 43: RESIDENTIAL BUILDING CONSTRUCTION CONTRACTS AWARDED

The solid line charts the percentages by which the 12-month moving average values are above or below the trend. The zigzag line diagrams a perfectly regular 32.3-month cycle. Source: *Cycles,* November, 1957, pp. 286—287.


1919
1920
1921
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1923
1924
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1926
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1929
1930
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6
8
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War
1946
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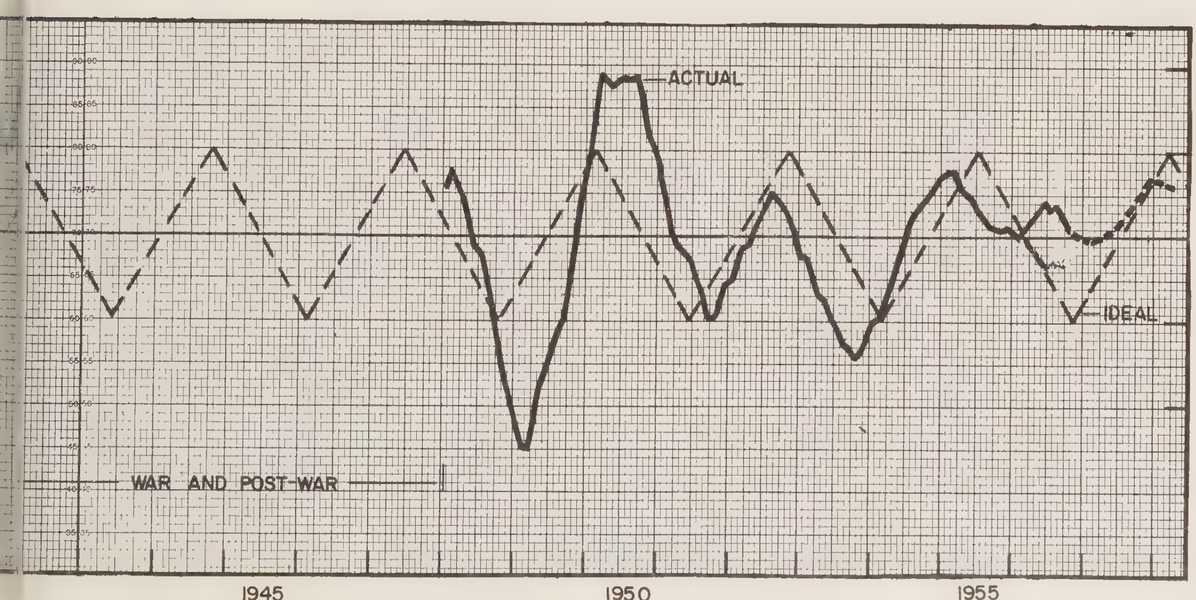
ACTUAL
IDEAL
WAR AND POST-WAR
1945
1950
1955

Illustrations of Latitudinal Passage

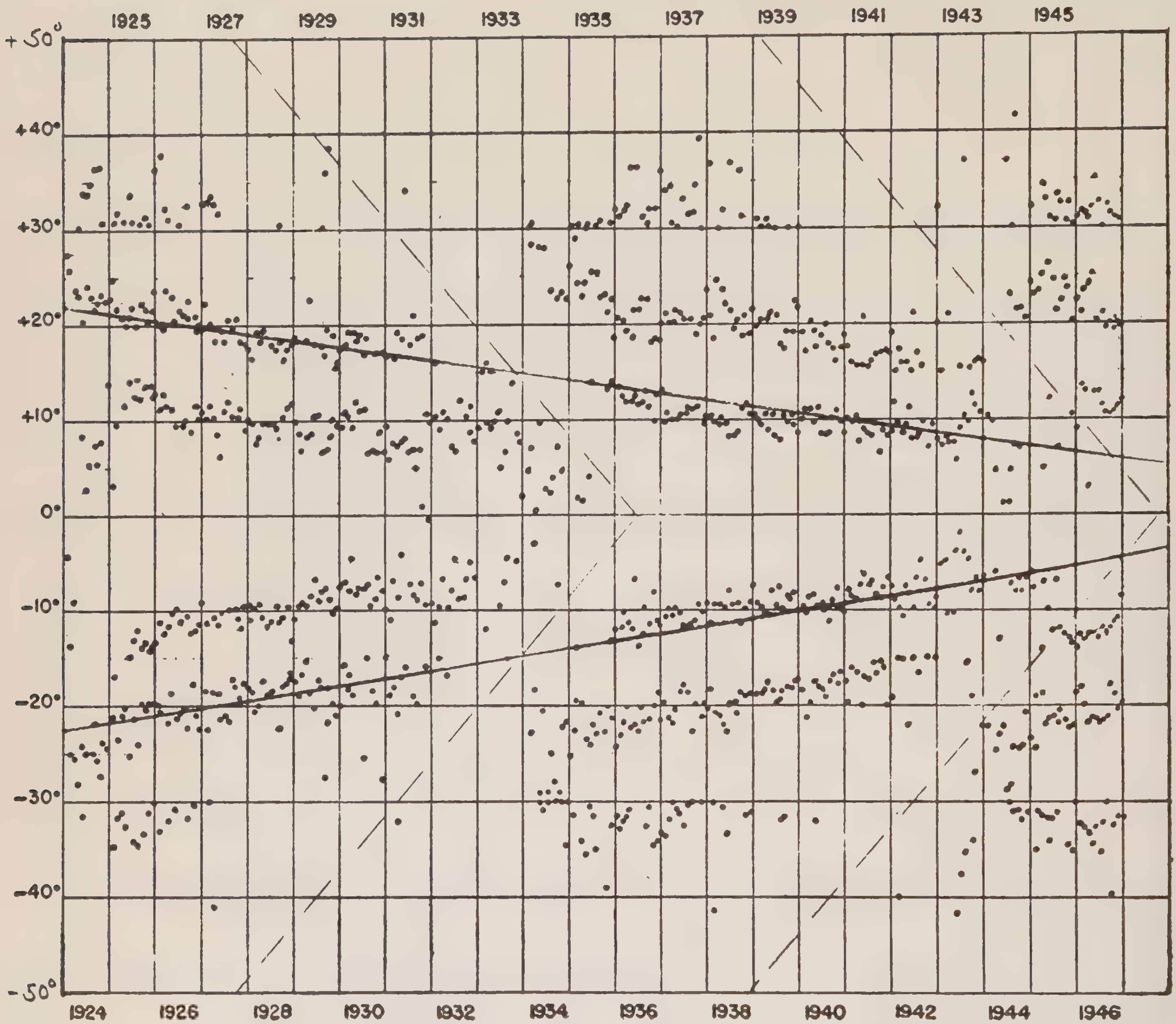

FIG. 44: LOCATION OF SUNSPOTS BY LATITUDE
JANUARY 1924—DECEMBER 1946

This chart shows the characteristic "butterfly" or latitudinal passage behavior so well known to students of sunspots.

To the basic chart above, reproduced from *Sunspots in Action* by Dr. Harlan True Stetson (The Ronald Press Company, 1947) broken diagonal lines have been added to show that the zones where there are few or no spots slip across the face of the sun about 1 3/4 years every 10^{o}. Starting at the equator these diagonal lines would reach the poles in about 15 1/2 years, which is about 70% of the double sunspot cycle of 22.3 years.

Note also that some of the spots seem to fall in bands which, if extended, would reach the poles in about 120 years. This time interval is about 70% of 168 years, a basic sunspot pattern length.

Other patterns can be traced.

Source: *Cycles,* November, 1958, p. 291.

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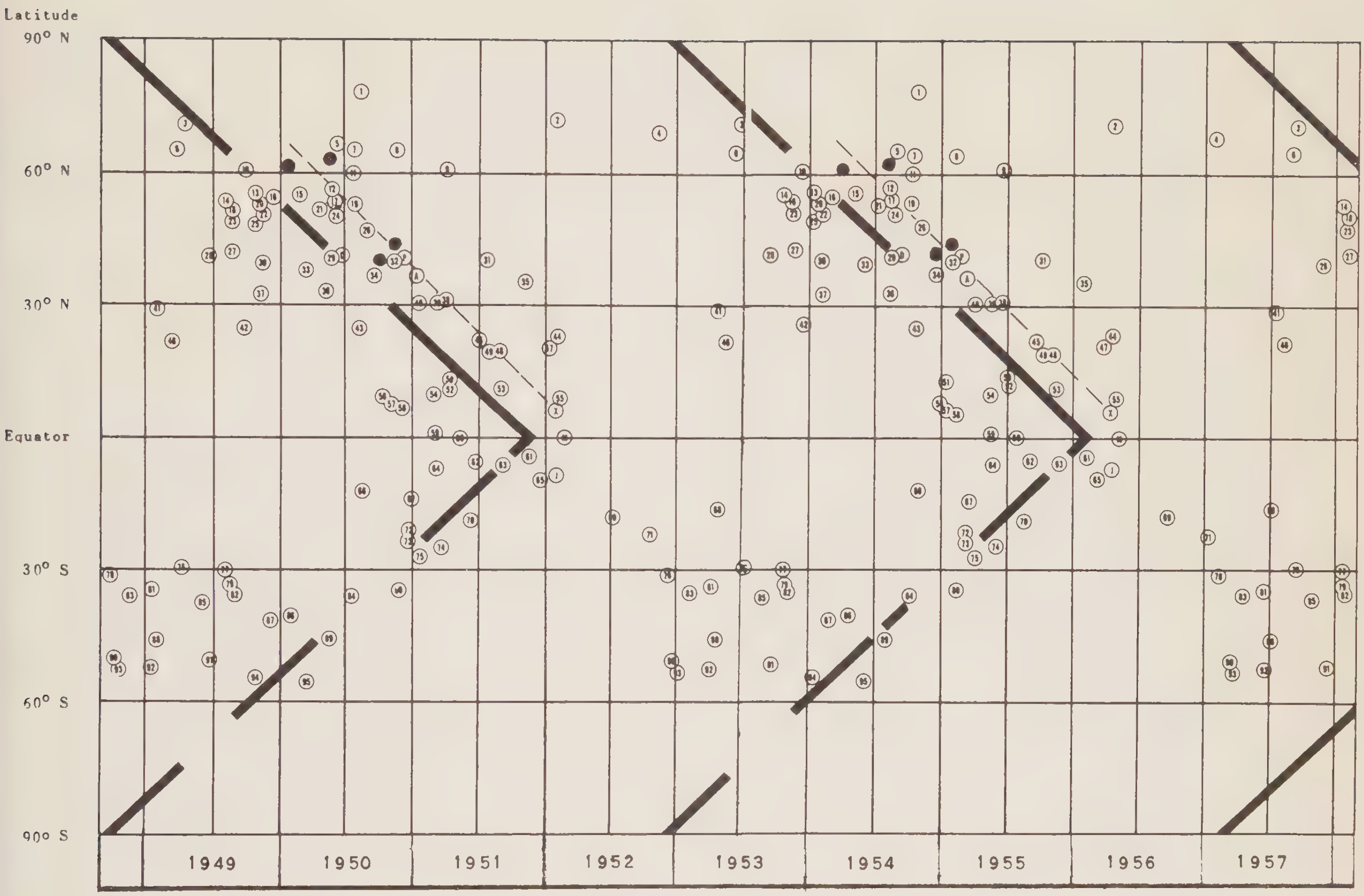

FIG. 45: THE 4.222-YEAR CYCLE IN TEMPERATURE AND IN OTHER PHENOMENA PLOTTED BY LATITUDE

The horizontal scale represents years. The vertical scale represents latitude. The numbered circles mark lows of the typical 4.222-year cycle in temperature for 97 weather stations throughout the world. Lettered circles are turning points of other phenomena. (Open letter circles represent lows. Solid letter circles represent highs.)

Note that in both hemispheres the temperature lows come later and later as the phenomena are found nearer and nearer the equator. This behavior creates a mirror image or butterfly pattern as indicated by the heavy diagonal lines. (Sunspots behave the same way.) The dashed line indicates the typical tree ring turning points (circles labeled A, J, N, P, V, and Y).

It seems unlikely that a latitudinal shift as definite as this could come about by chance.

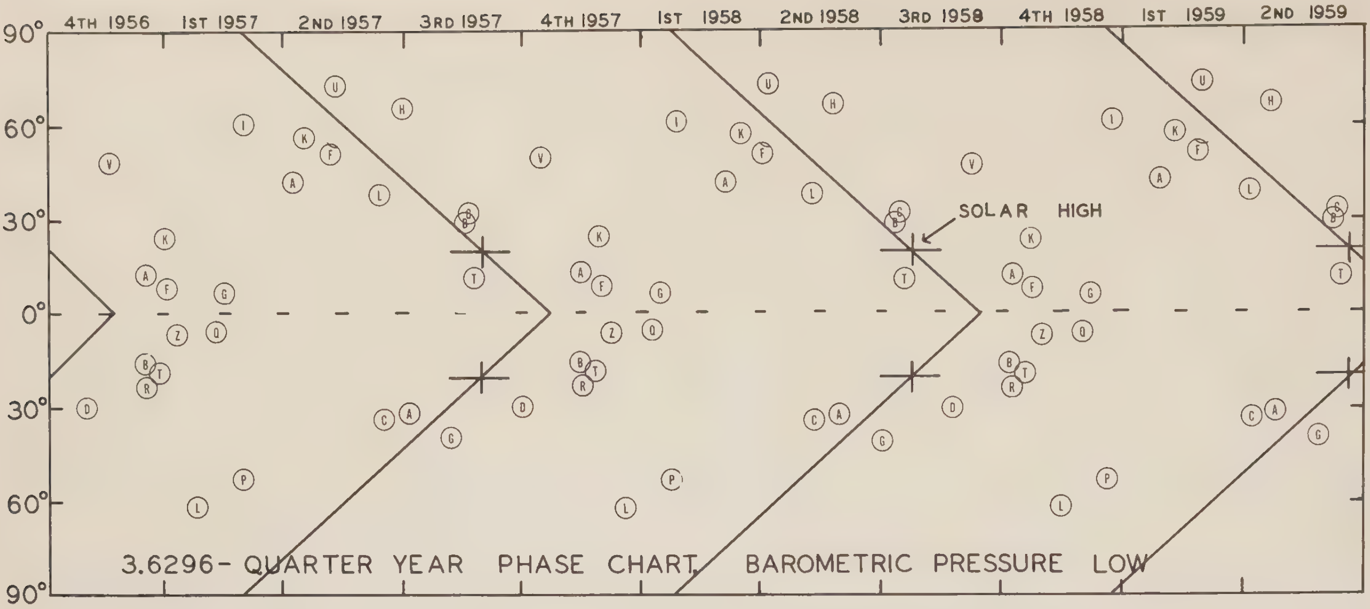

FIG. 46: A 3.6296-QUARTER YEAR PHASE CHART OF BAROMETRIC PRESSURE EPOCHS ("LOWS")

The symbols used represent the typical low obtained from 3.6296-quarter year periodic tables of the deviations of the logs of the data from their 5-year moving average. Fifteen stations in the New World and 11 Old World Stations were used, and each symbol represents a different station, such as U for Upernivik, K for Key West, etc. The symbols are plotted at the date of the low according to the time scale across the top of the chart and according to the latitude of the station as noted at the left of the chart. The sunspot timing is shown by the solid diagonal lines. Source: *Journal of Cycle Research,* July, 1959, pp. 80—81.

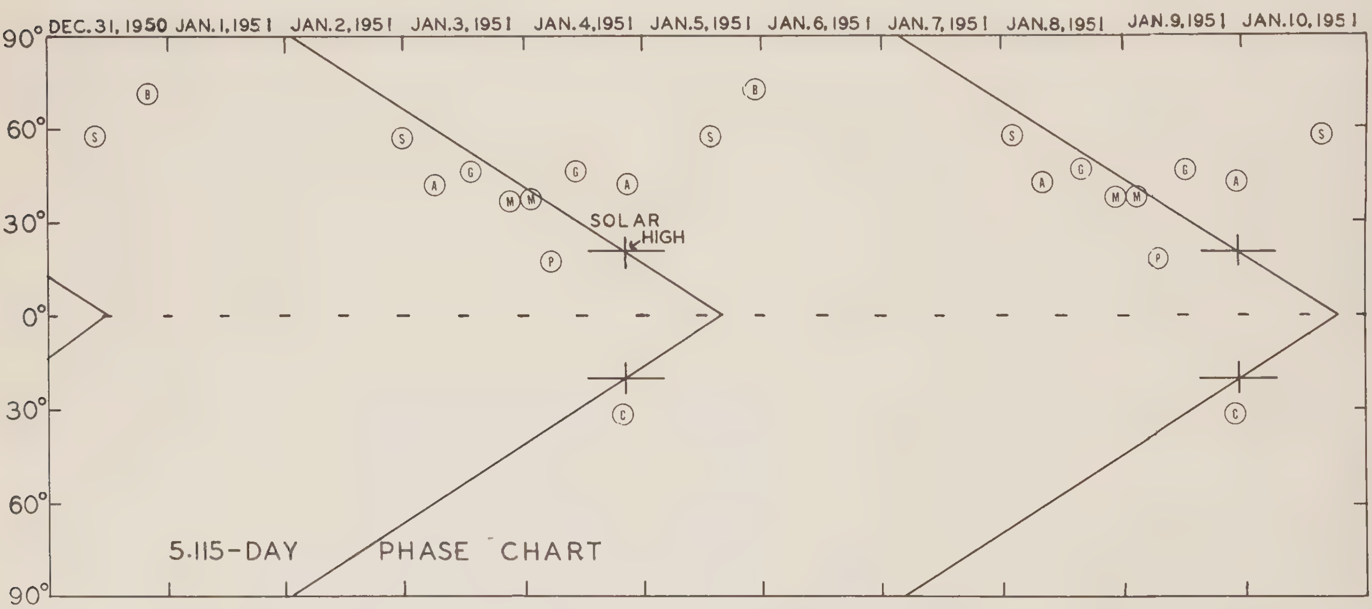

FIG. 47: A 5.115-DAY PHASE CHART OF TEMPERATURE AND H-MAGNETISM EPOCHS

The symbols used represent the epochs obtained from 5.115-day periodic tables of the sun, temperature, and/or H-magnetism at Barrow, Sitka, Grand Marais, Ann Arbor, Cheltenham, San Juan, and Cordoba. The symbols are plotted at the date of the low according to the time scale across the top of the chart and according to the latitude of the station as noted at the left of the chart. The sunspot timing is shown by the solid diagonal lines. Source: *Journal of Cycle Research,* July, 1959, pp. 82—83.

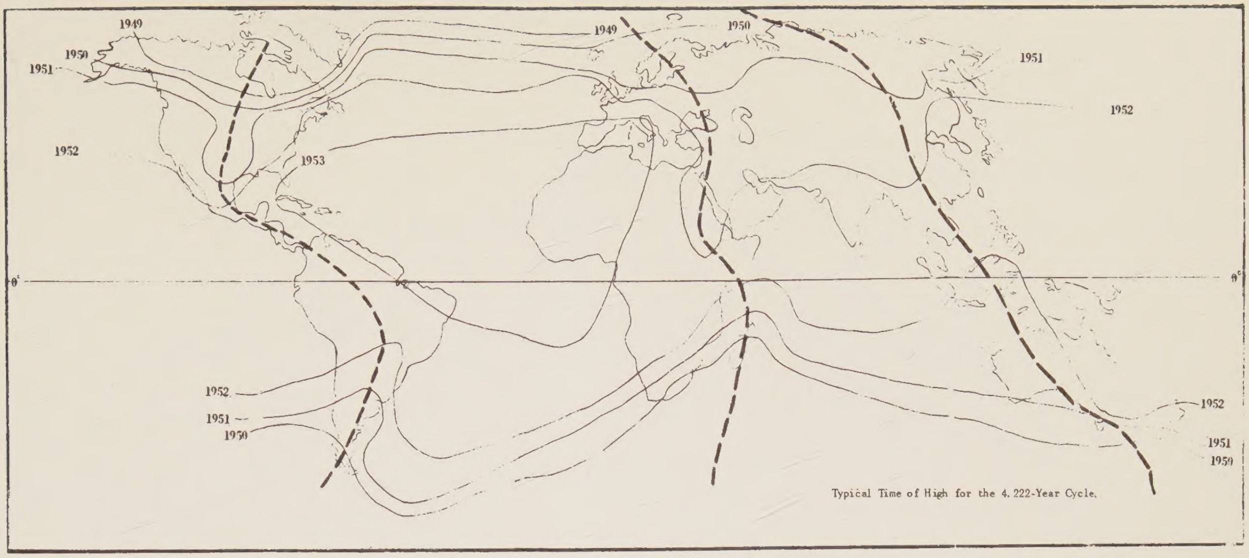

FIG. 48: WORLD MAP SHOWING LATITUDINAL PASSAGE

The lines drawn on the map show the typical time of high for the 4.222-year cycle in temperature. The lines show that cycle highs appear first in the polar regions and that they come later and later as we find them nearer and nearer to the equator. This behavior is called "latitudinal passage."

The lines bend toward the equator in zones as shown by the heavy broken lines. This means that in these zones, the crests of the cycle move equatorward ahead of the rest of the globe. It is an effect which may be related to land mass. Similar behavior can be noted in magnetic variation (see Fig. 49). Source: *Cycles*, June-July, 1955, p. 178.

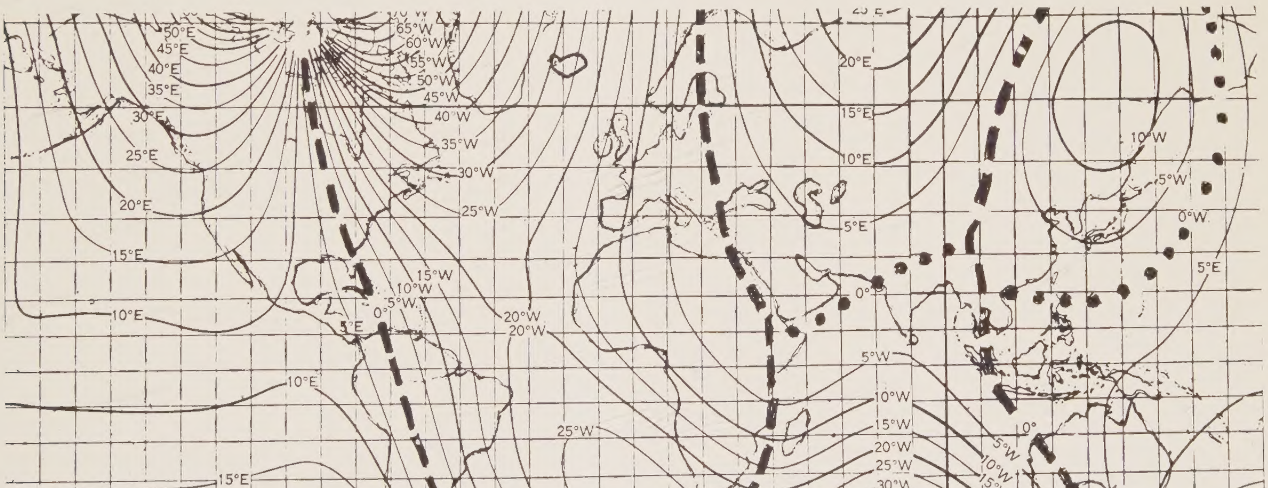

FIG. 49: WORLD MAP OF MAGNETIC DECLINATION

The variation of the compass from true north (declination) shows an influence of land masses upon terrestrial magnetism. On this map, obtained from government sources, we have placed broken lines to indicate the zones of zero declination, except in Africa where it marks a zone of minimum relative variation. The similarity of position between these lines and the broken lines of Fig. 48 is provocative. Source: *Cycles*, June-July, 1955, p. 179.

Illustration of a Cycle Family

TABLE 3

THEORETICAL CYCLE LENGTHS

(DOUBLE AND TRIPLE PROGRESSION UP AND DOWN USING 17.75 AS A BASE.)

AND OBSERVED CYCLES WHICH MORE OR LESS CORRESPOND

Theoretical Cycle	Found in---	Observed Length
479.3 yrs.	Not yet found	
319.5	Not yet found	
213.0	Not yet found	
159.8	Pig Iron Prices	159 yrs
106.5	Women's Fashions	105
142.0	Number of International Battles	142
71.0	Not yet found	
53.3	Arizona Tree Rings	54
	Prices, U.S.A.	54
	Prices, Germany	54
	Prices, Great Britain	54
	Coal Consumption, France	54
	Coal Production, England	54
	Lead Production, England	54
	Number of Textile Workers, England	54
	Wages of Agricultural Workers, England	54
	Value of French Rente	54
	Value of English Consols	54
	Pig Iron Production, England	54
	Copper Prices, U.S.A.	54
	Cotton Acreage, U.S.A.	54
	Deposits in Savings Banks	54
	Foreign Trade (Imports & Exports)	54
	Interest Rates, U.S.A.	54
	Oat Acreage, U.S.A.	54
	Ship Building, U.S.A.	54
	Devaluation in England	54
	British Wheat Prices	54.0
	Railroad Stock Prices, U.S.A.	54.6
35.5	Abundance of Lynx in Canada	35.2
	Frequency of Aurora	35.9
	Frequency of Earthquakes in China	35.2
	European Weather	35.5
	Barometric Pressure of Batavia	36
	Manufacturing Production, U.S.A.	36
	Wheat Prices in Western Europe	36
	Immigration into U.S.A.	35
	Plant and Tree Growth in England	35
	Thickness and Thinness of Tree Rings in England	35
	Harvests in Europe	35
	Value of English Consols	36
17.75	Industrial Stocks	17.78
	A large mail-order house	17.75
	Failures	17.75
	Sunspots, alternate cycles reversed	17.66
	Pig Iron Prices	17.69
	Cotton Prices	17.75
	War	17.73
	Earthquakes	17.66
	Tree Rings, Arizona	17.75
	Variable Star, Scorpius V 381	17.724

Theoretical Cycle	Found in---	Observed Length
8.875 yrs.	Pig Iron Prices	8.9 yrs.
	Widths of pre-glacial tree rings	8.85
	Sunspots - Lane	8.76
	Sunspots - Stumpff	8.8
	Sunspots - Clayton	8.94
5.916	Cotton Prices	5.91
	Pig Iron Prices	5.91
	Copper Prices	5.91
	Sunspots with alternate cycles reversed	5.91
	Tree Ring Widths	5.91
	Railroad Stock Prices	5.9
	Industrial Stock Prices	5.93
	Dozens of other series of figures	6.
	Wheat Prices in Western Europe	5.96
	Liabilities of Failures	5.90
	One half of the time it takes the planet Jupiter to go around the sun	5.931
	One fifth of the time it takes the planet Saturn to go around the sun	5.892
	One forty-second of the time it takes the planet Pluto to go around the sun	5.915
4.438	Sales of Company G	4.37
	Industrial Common Stock Prices	4.4
	Railroad Stock Prices	4.4
	Pig Iron Prices	4.44
	Advertising Effectiveness of Pinkham Medicine Company	4.41
	European Wheat Prices	4.41
	Temperature	4.41
Months		Months
35.5 mo.	Factory Sales of Passenger Autos	36.0 mo.
	Common Stock Prices	35.6
	Common Stock Prices	36.2
26.63	Not yet found	
23.6	Factory Sales of Automobiles	23.6
	Industrial Stock Prices	23.7
17.75	Industrial Stock Prices	17.8
13.31	Industrial Stock Prices	13.3
11.83	Industrial Stock Prices	11.9
8.88	Sales of Company G	8.8
	Bank Debits	9.
7.89	Sales of Company G	7.92
5.92	Electric Potential of Trees	6.
	Industrial Stock Prices	5.9
3.94	Electric Potential of Trees	4.
	Sales of Company G	4.05
	Industrial Stock Prices	3.937

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